Willowrise Gardens Permaculture Design

Chas Hathaway

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Site Assessments

Personal Survey

Chas Hathaway

Questions:

Age: 39

Educational background:

I have an Associates Degree in Music.

How did you hear about permaculture?

All my life I've been drawn to a wild, untamed style of gardening, where plants could mingle like a giant forest family, supporting instead of competing with one another. Even as a child, I'd spend my allowance on houseplants and garden seeds. My parents gave me a little patch of the yard and I grew a wild assortment of flowers and foods.

I've long also been interested in wild edible plants, their properties, and nutrition potential.

As an adult, (perhaps ten years ago or so?), after having a particularly successful year with my wild garden, I was looking for methods that engaged my style of gardening, when I came across the word *permaculture*. I'd never heard of it before, so I searched up the word, and was instantly sucked in. Ecosystems, nature-mimicking, function-based farming, it was all so fantastic! I've been hooked ever since.

What is your background in gardening/farming/design?

Once I discovered the word, permaculture became my go-to for gardening. I redesigned my 1/10 acre property with several diverse plant guilds, a tiny make-shift pond, several more trees, a hugel hill next to my front porch, and a network of maze-like grass trails for the kids to run on.

The result was both educational (not *all* went as planned, but some things went better than planned) and addictive. When we moved to our 5-acre home in 2015, I was like a kid who'd just been handed a lego factory. But it didn't take long to discover that 5 acres was not just a bunch of 1/10-acre lots squished together. This was a whole new ballgame, but one I've engaged with vigor.

Last year, we started a chicken/duck/goose farm in order to make a little money to do our permaculture design projects. Now we have a little tucked away for that purpose (and a bunch of birds). As an exceedingly poor family, penny-pinching is not only our habit, but it's the only way we can make any of this work. We've gotten pretty good at it, but in the process I've come to realize that thrifty permaculture may just have to be my forte—which isn't necessarily a bad thing, since most of the world (which very much needs permaculture) is poorer than we are. So one of my goals is to learn to design based on *very* little money, and in so doing get good enough at it to be able to help guide and teach others around the world who have no cash but a lot of heart.

Do you have other relevant experience to this course?

My experience chicken, duck, and geese farming has taught us a lot about the relationship of animals to the landscape. It has become clear how animals can be used to help build, protect, and strengthen the structures desired.

How do you want to integrate permaculture into your life? (Highlight all that apply)

* *I want to use it for personal design/installation.* Specifically, for my own property.

* *I want to become a designer/installer.* I'd love to teach permaculture locally, as the need is almost as high as the demand. There are many locally interested in the subject, but I know of no local teachers.

* *I want to incorporate it into my existing work.*

If so, what do you do?

I'm already a podcaster, and I'd love to develop a permaculture podcast. I started one about a year ago, but only kept it up a short time, and hope to start it back up again. I'd also like to find more farming methods that can bring in some financial support. My bird farming has mostly only supported the farm itself and some additional permaculture projects. My hope is that those projects will bring in more opportunities to make our farm self-sustaining enough to provide some discretionary income as well.

I'm concerned about the state of the world.

Frankly, I find the scare tactics of energy crisis and air pollution fairly useless so long as our only methods to deal with the problems is the slowing of our inevitable descent. Permaculture is the first solution I've heard that flips this negativity on its head and provides a positive solution that not only fixes the problems, but provides a much more beautiful and enjoyable world, culture, and home.

I hope to apply this to homesteading or similar activities. 100%

I want to enhance my skills. Big time.

What are your goals for the course?

I really want a permaculture design certificate. But on top of that, I want to make sure there are no gaps in my self-directed education. You can never tell what you don't know until you hear it all. Obviously, this course won't cover every possible thing that permaculture can teach, but I suspect it will provide a comprehensive overview, from which we can dig deeper and deeper in our personal studies.

What's success look like for you when the course ends? What will you know? What capacities will you gain?

Success is an important word to me. I've come to define success as "Having the resources I need to support my family doing work I love that makes a difference for good in the world."

I can see so many ways permaculture does that. And though many of the skills and capacities I get from this course will only be sufficiently refined after the long implementation of those things, I do hope this PDC helps me learn how to make my family self-reliant in an ecologically friendly—even beneficial way. Eventually want the world to be a better place because of what I've done to my property, what I've taught others to do with theirs, and the perspectives I've perpetuated about how all of us, no matter our circumstances, can make a difference for good.

What level of interaction do you expect to have with the course?

Master – completing all assignments, responding to feedback, and earning my certificate

What are your expectations of this course?

Learning any principles of permaculture I have not yet fully integrated into my own philosophy, and obtaining certification to be able to demonstrate what I have learned, am learning, and have done.

Climate Survey

Chas Hathaway

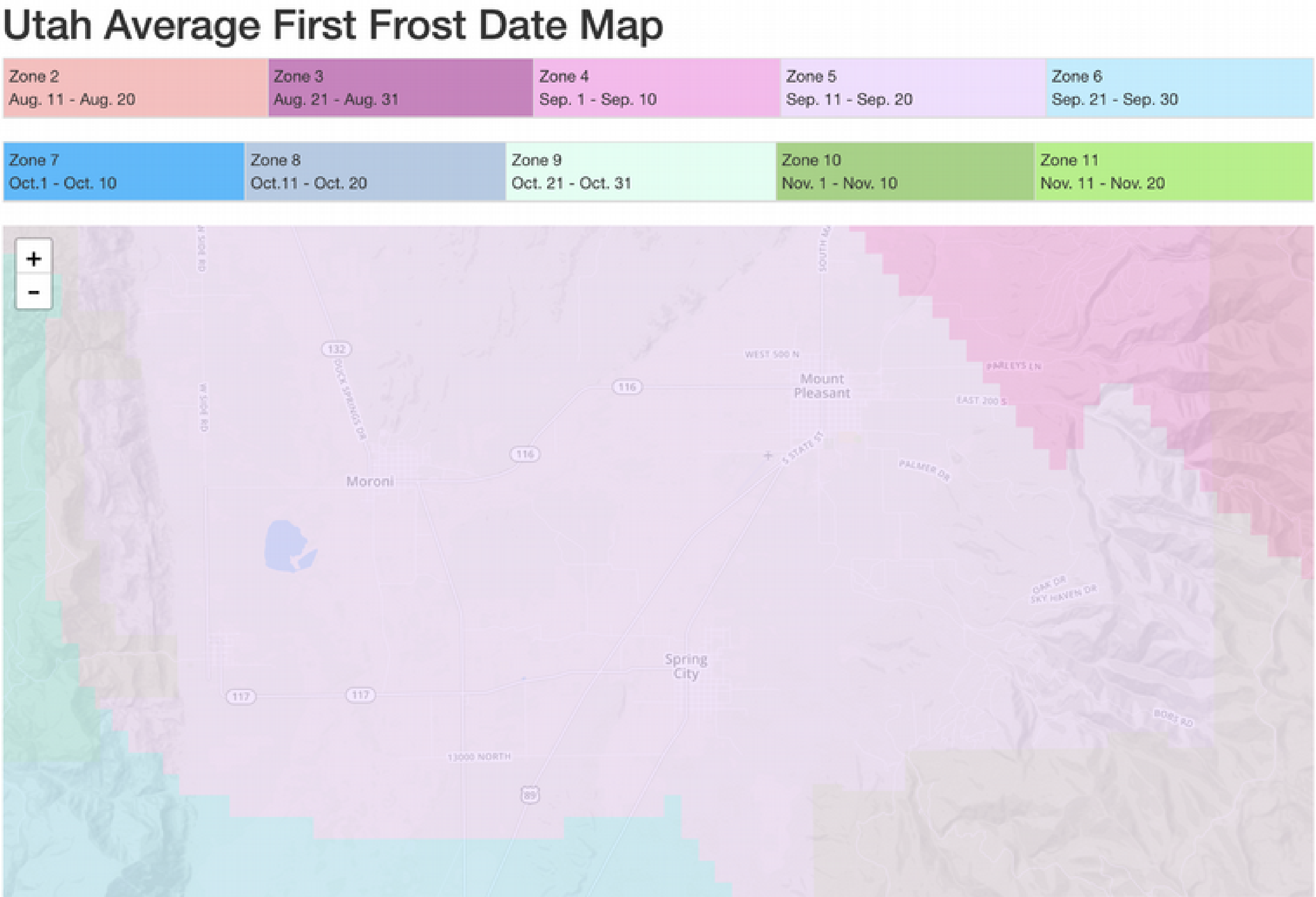
Please answer the survey questions to the best of your ability. Include photos and images to support your answers where applicable.

For Spring City, Utah

Questions:

1. *First and last average frost date:*

Last frost date: 30 June (21-30), first frost date: 11 Sep (11-20 Sep)[1]



Utah Average First Frost Date Map

Zone 2 Aug. 11 - Aug. 20
Zone 3 Aug. 21 - Aug. 31
Zone 4 Sep. 1 - Sep. 10
Zone 5 Sep. 11 - Sep. 20
Zone 6 Sep. 21 - Sep. 30
Zone 7 Oct.1 - Oct. 10
Zone 8 Oct.11 - Oct. 20
Zone 9 Oct. 21 - Oct. 31
Zone 10 Nov. 1 - Nov. 10
Zone 11 Nov. 11 - Nov. 20

2. *Average annual rainfall and average annual snowfall:*

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[1] https://www.plantmaps.com/interactive-utah-first-frost-date-map.php

Average rain: 15 inches. Snowfall: 47 inches

3. *Average lowest yearly temperature:*

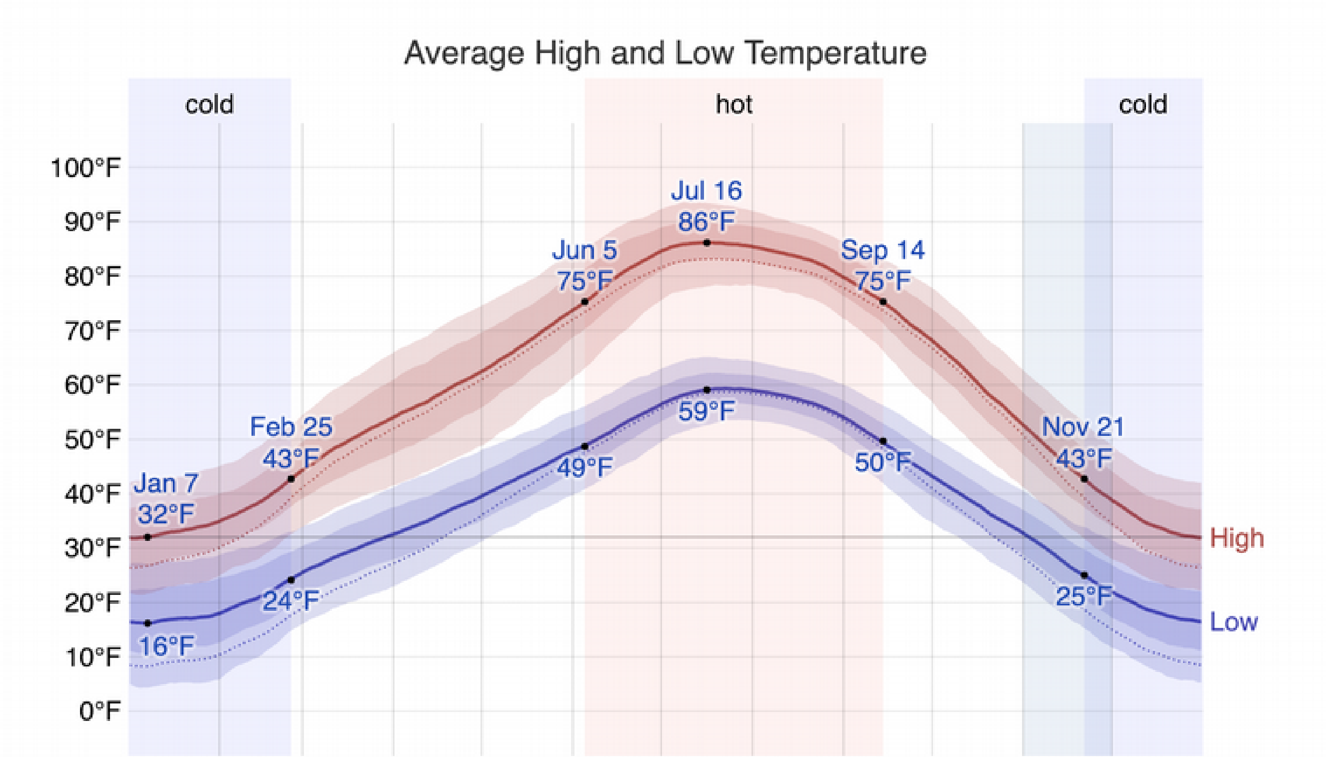
13 degrees (Fahrenheit)

4. *All time record low temperature (what year?):*

-27° (1971)

5. *Average highest yearly temperature (in what month?):*

87 degrees[2]



The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.

6. *All time record high temperature (what year?):*

103° (2002)

7. *Any other interesting climatic data you run across:*

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[2] https://weatherspark.com/y/2661/Average-Weather-in-Spring-City-Utah-United-States-Year-Round

75% of our annual precipitation comes in snowfall in winter. That might be useful if we can find a way to harvest snowfall for water storage.

Design Project Site

Chas Hathaway

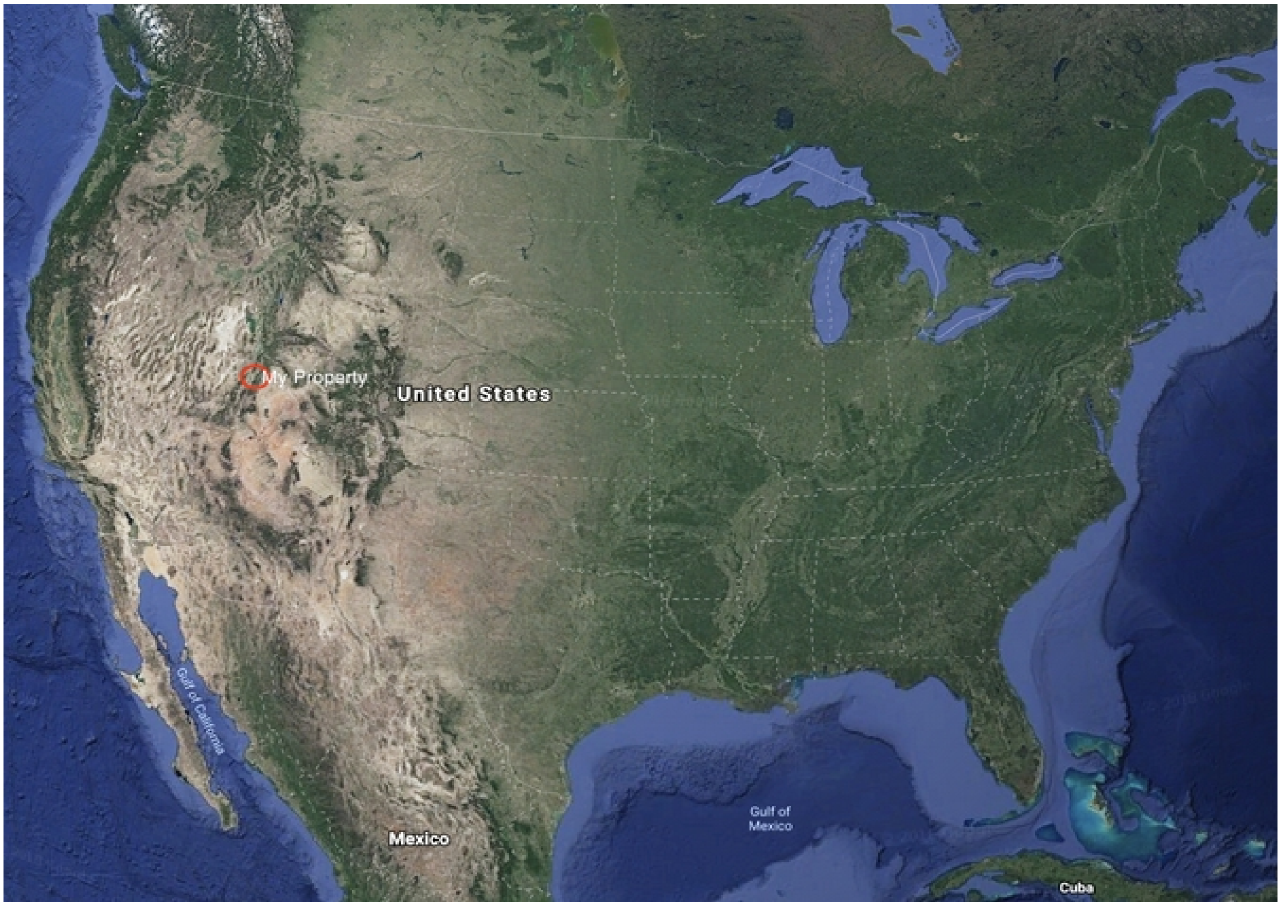
Choosing your design site:

The site I've chosen to design is our 5-acre homestead. It will be a work in progress, so I do not expect the final plan to match the final result, but the plan can help point my efforts in a logical direction. Also, depending on the time required for each aspect of the design, I may focus on a portion of the site (perhaps 1-2 acres) for now, with the idea that I can design the rest later.

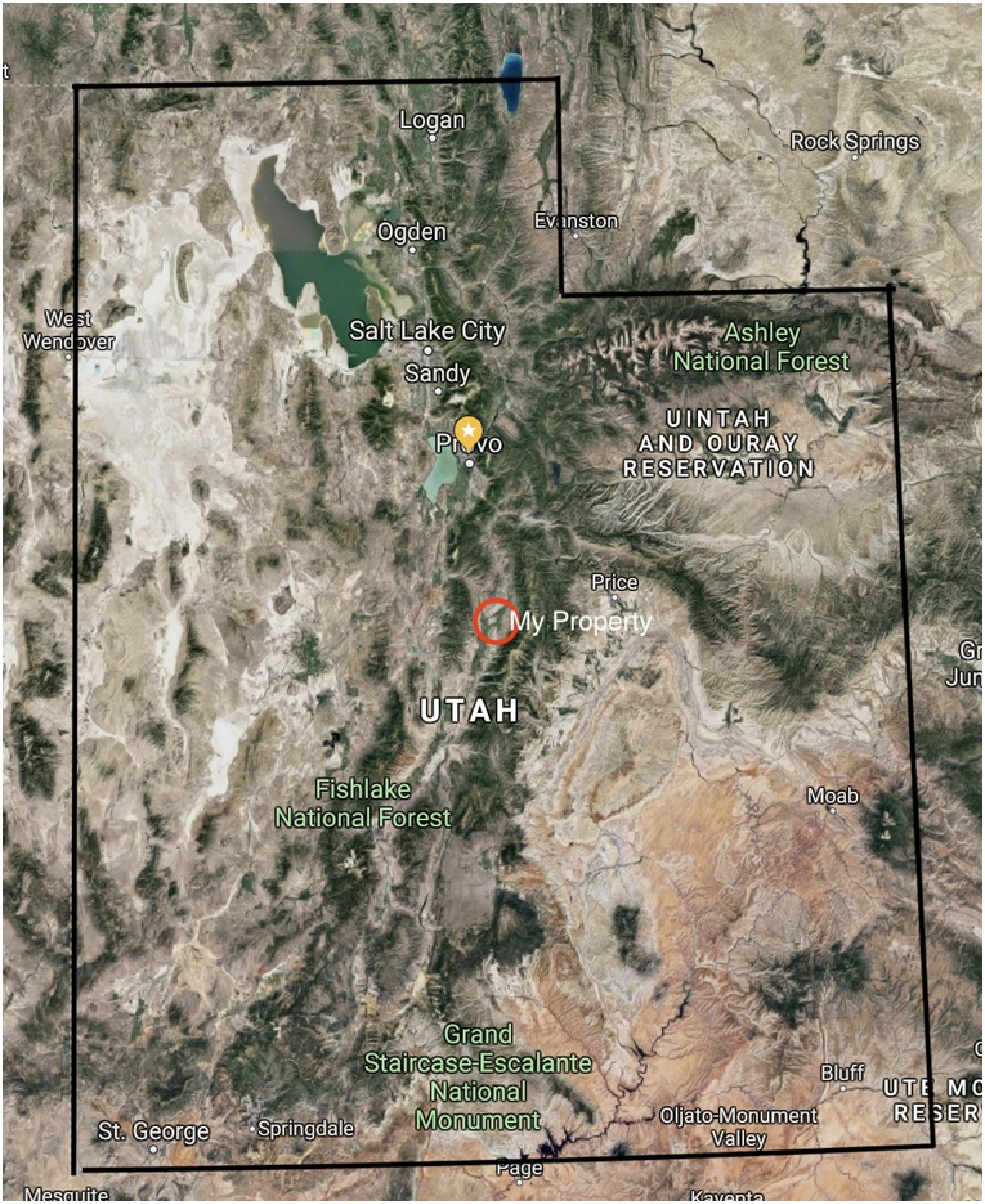
Assignment elements:

Your choice of a design site will be accompanied by these images:

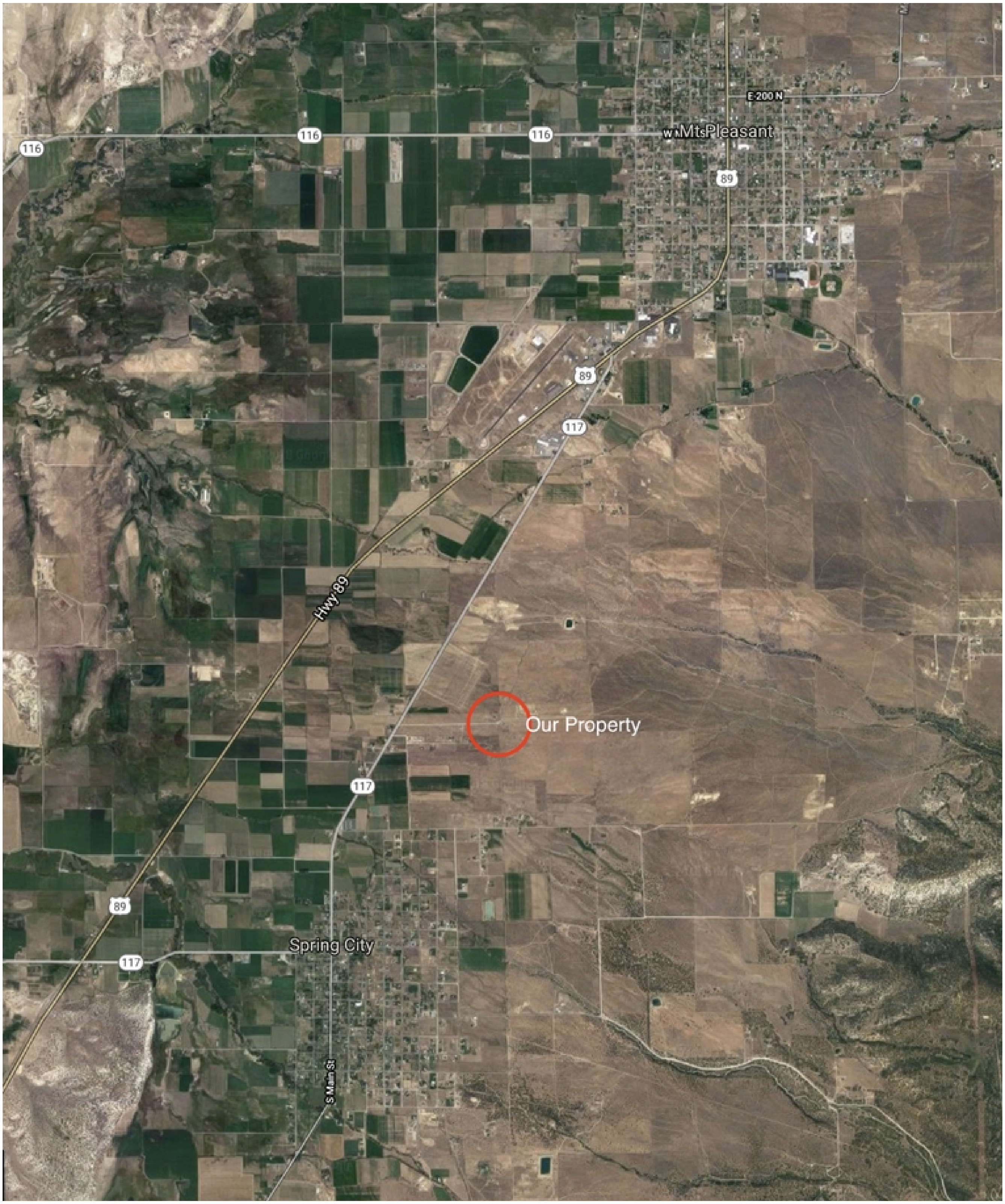
1) Image showing where your site is located within your country.



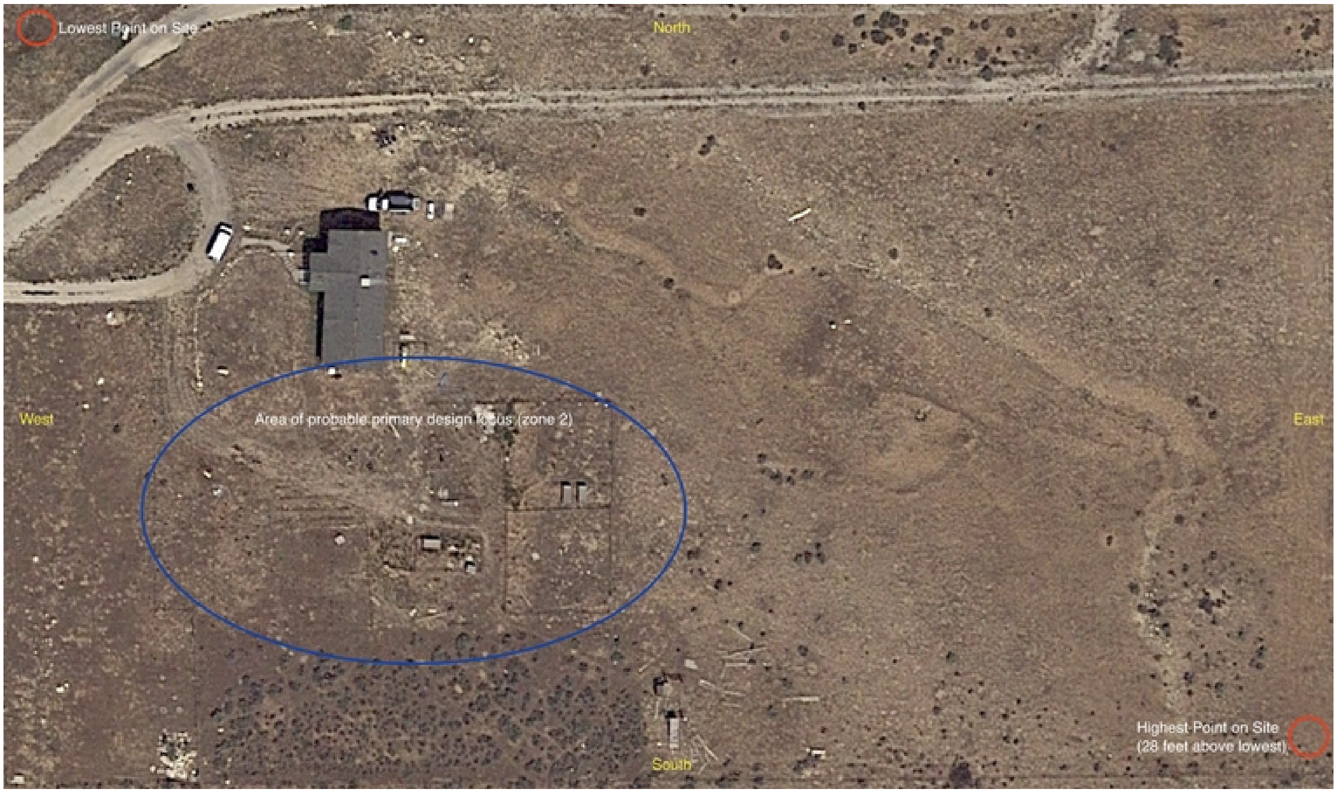
2) Image of your site within the state or province


Logan
Rock Springs
Ogden
Evanston
West Wendover
Salt Lake City
Ashley National Forest
Sandy
Provo
UINTAH AND OURAY RESERVATION
Price
My Property
UTAH
Fishlake National Forest
Moab
Grand Staircase-Escalante National Monument
Bluff
St. George
Springdale
Oljato-Monument Valley
Page
Mesquite
Kayenta

3) Image of the site showing its proximity to the nearest town or city center



4) A satellite image of your design site (from Google Maps or Google Earth)



5) Some photos of your design site, ideally looking towards the highest and lowest points, as well as any other major features of importance. (Make sure to label where photos were taken from).

The site primarily looks like this:

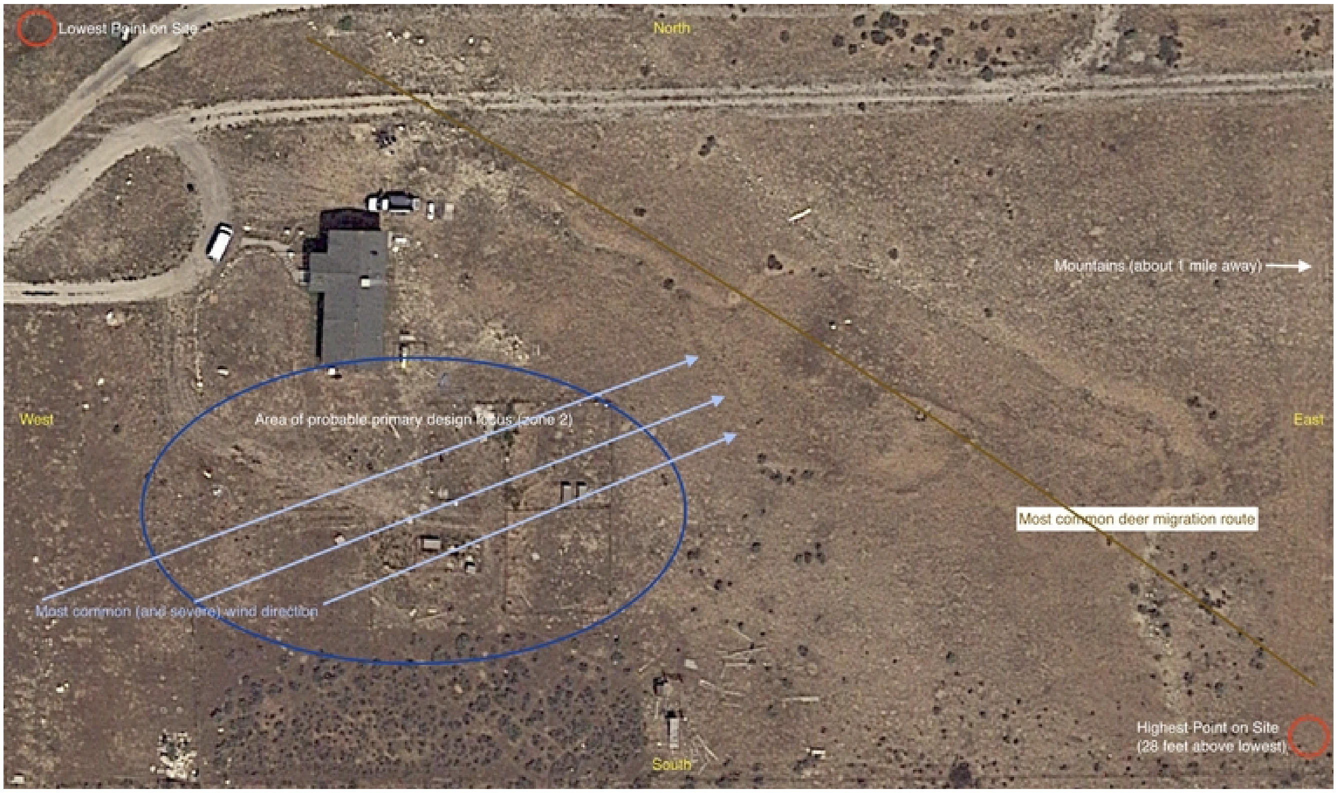
I would consider it desert mountain-prairie. Clearly it was once grazed, as there is little brush around it (like much of the surrounding area), but gratefully, it hasn't been flattened out.

Prior to my arrival, there wasn't a single living tree on the site. Aside from the brambles and brush, there are several worthwhile wild edible plants, including tumble mustard (*Sisymbrium altissimum.* When young, it looks, tastes, and can be used exactly like arugula), Lambsquarters (*Chenopodium albumi*, if my ducks haven't finished it all off by now), Russian Orach (*Atriplex heterosperma*).

Here's a photo of our house on the property. Sitting at the lowest (northwest) corner of the property, most of the water on the property bends it's way slowly toward the house. This can be good in some ways, as we can plant our kitchen gardens and a few fruit trees close to the house, and they may get water more easily. The disadvantage to this is that the pressure coming from our well, out through a hose, only gets about halfway up the property before the pressure is not enough to get water through the entire hose. Basically, we don't yet have a simple way to transport water to the higher half of the property.

From the lowest (northwest) point to the highest (southeast) point is a difference of 28 feet. These two points are running corner to far corner, making the grade about 2.1° (or 3.8%) slope.

Here are a few more property notes:


Lowest Point on Site
North
Mountains (about 1 mile away)
West
Area of probable primary design focus (zone 2)
East
Most common deer migration route
Most common (and severe) wind direction
Highest Point on Site
(28 feet above lowest)
South

Client Interview—Chas Hathaway

Client Profile

Property Owners Names and Ages:

Chas Hathaway (39), Jenni Hathaway (35), and children: Kaceeus (13), Sadie (12), Ben (11), Jadie (9), Lucy (7), Kadie (4)

Your relationship to the Clients and to the owners (if different)?

Me, my wife, and children

Client Occupations:

Housecleaner, musician, author, and podcaster

Amount of time available for maintaining property:

1-6 hours a week.

Initial Budget for implementation:

$200

Who has the ability to make veto decisions for the site? (These are individuals that could approve or block a major change):

Me and Jenni

What's the client's dream for the property?

A (nearly) completely self-sustaining food forest, with lots of fruit trees, perennial herbs, and a few small animals

General Lifestyle (active, sedentary, lots of travel etc.):

Creative, easy-going, active, and rather poor.

Special requirements:

We have several children (and will one day have grandchildren). I would like to design the property to be both child-safe and child-resilient.

Hobbies:

Music, art, dancing, yard work, writing, research, crafts, and watching a favorite TV series.

How long have you lived at this site?

We bought this property in August of 2015, so we've been here 3 ½ years. It was a bank-owned property, and appears to have been left alone for at least a couple years or so.

How long do residents plan to live at this site?

Hopefully until I'm old, grey, and dead. Maybe even longer if I can get a license to designate a family grave plot.

Client's Desired Outcomes

I would love to grow my property into a self-sustaining food forest with enough varieties of fruit and vegetable perennials to make the property worth keeping in the family long after I'm dead. I'd love to design it so well that even if none of my family *lives* in the house someday, they'll want to keep it in the family for the sake of the plants and seeds they can take from it to grow on their own properties someday. If it provides enough food, it could be a good food/emergency preparedness location if things get rough in generations down the line.

Water systems (What is existing supply, and future needs for domestic, agricultural, storage?)

1) Existing: Well

2) Desired: I'd love to establish a really good passive water harvesting system, including some methods for catching and storing water from snow. I'd also love to have a wind or solar powered well pump, as well as a hand pump, so that electricity isn't required for water. I'd also love to make all our water-based appliances (washer, sink, shower, bath, etc) have grey water capacity, so that they can be interchanged between using the septic tank and going out into service in the yard. For most, into the yard will be the default.

Lighting: paths, buildings (existing and future needs)

1) Existing: Electrical lighting, and a few outdoor solar lights.

2) Desired: Though it would be cool to someday be able to produce enough of my own electricity to light the inside of the house, outdoor lighting is not a priority. We have such incredible views of the sky and stars that excessive light in this area makes obvious light pollution. A few small solar lights lighting the way for safe walking on major paths is probably as much as I'll want.

Structures: (What are existing and desired structures; i.e. house, greenhouse, shop, barns, chicken house etc.)

1) Existing: House, a tiny rock shed (a shed where my late grandpa's rock collection is stored), several really simple chicken coops, and a greenhouse that is in progress. It's about 20 foot by 10 foot.

2) Desired: Wood shed. Other structures that I'd love to have in the distant future (but are not on the menu for the next several years at least): small animal barn, root cellar, underground water storage units, windmills, solar panel, heated/cooled workshop, and as mentioned, family grave plot.

Heating, cooling, electricity (What are existing sources and desired sources?)

1) Existing: Wood-burning stove, Electrical (oven, stove, washer, dryer, refrigerator), and Propane (water heating).

2) Desired: Passive solar water-heating for warm season, wood-burning water heater in cold season. I'd also love to come up with some alternative cooking methods so there is the potential for independence from electricity. We plan on putting a good large clothes-drying line out for drying clothes, and would love to find some alternative clothes-washing methods that don't take too much more effort than electric washers (though a little more effort is fine and expected).

Utility areas: clothes line, recycle and trash, wood, service equipment (existing and future needs)

1) Existing: For clothing, we use a washer and dryer. For garbage, we have to drive our garbage a half-mile to the street for garbage pickup. Food scraps all go to the chickens (if the cat doesn't get to them first). Cardboard is fire kindling, and lumber wood is either used in building/fencing projects, burned for heat, made into animal housing, or buried in hugelbeds. Branch wood is used similarly, but are also used for fences, animal wikiups (the birds especially love these), compost, and wood-chips. Smaller wood and sawdust are composted or used for animal bedding. We get a lot of branch wood, because we've sent word around town that people can drop their tree-prunings on the corner of our property. Not only are they useful for fences and wikiups, but we've sprouted several to get new trees. And unless cars count, we have no service equipment.

2) Desired: Electricity-free washer and clothesline. A truly efficient and practical (it's so hard to get kids on board with this stuff) closed-loop recycling system for everything garbage except toxic chemicals (which we avoid as much as we can anyway). A truck for wood hauling, material transportation, and snow-plowing. Alternatively, a tractor would work for snow-plowing, though I'd prefer a vehicle that can do more than one thing. I'm no mechanic (probably never will be, with how much I struggle with it now), so high-maintenance vehicles aren't big on the radar.

Children's areas: (existing and future needs)

1) Existing: Indoors is one big playground, really. Outside, we have a small playground for the younger children. There is also a small hill for sledding. While the property is undeveloped, most of it is available for play. The kids enjoy many outdoor games, such as capture-the-flag and fugitive.

2) Desired: We've considered designating an acre or so as a capture-the-flag arena—perhaps at the top of the property where we can't yet get water up to it. There could still be large trees, hedges, and maybe even a small shed in the area, but most of it would be designed to allow hard-core play—even paintball, if my kids/grandkids are into that sort of thing. We also try to have areas for the animals that the children can visit to

play with the animals, but also want animal “safe” areas that the kids can’t get into (but the animals can) if the animals are done with the attention.

Level of food self-reliance (present and future): diet and taste preferences

1) Existing: I’m getting pretty good on the edible wild-plant thing, and find that we can supplement salads quite easily—but otherwise are not food self-reliant much at all at the moment. Though it’s hardly a self-sustaining factor initially, recently Utah food stamps (SNAP), which we are on, approved the purchase of fruit trees. This means that we can use part of our food stamps to purchase fruit trees. While we’re on SNAP, we’d like to get as many fruit trees into our system as possible.

2) Desired: I would love to one day be entirely self-sustaining with apples, peaches, pears, apricots, cherries, nectarines, plums, grapes, strawberries, raspberries, rhubarb, and as many other perennial fruits we can establish. These just mentioned are all known to grow well here if done right. We’d also like to establish as many perennial vegetable systems as possible, including many reseeding or root-dividing annuals, such as those in the amaranth, onion, brassica, and carrot families. I’ve noticed that hardy biennials have little trouble establishing here if we allow them to do so. While we have little interest in raising dairy or meat animals, we would like to get well-enough established fruits and vegetables to be able to trade for our needs in the community. Thus, our focus on growing some of the foods that are much desired, but aren’t commonly raised here, but grow well, should be included.

I also wouldn’t mind growing enough grains to feed my birds, if possible. Obviously we’d have to do some calculations to figure out how many birds would be supported by so much grain, etc. But perhaps there are tree species that could provide bird-feedable seeds, too.

If I could have nothing else work out from all of of my permaculture efforts, I want perennial food systems—especially fruit trees. I’d trade all my hopes for animal systems, energy-producing systems, and grain systems for a good fruit/nut tree forest.

Does income need to be produced from the property?

1) Existing: We do have some success with raising, breeding, and selling chickens, ducks, and geese. This doesn’t provide a great deal of income, but it covers the cost of feed and a few improvements on the property.

2) Desired: As an entrepreneur, I'm always looking for ways to make enough money to survive, but also find it very challenging to do. I'd be happy to sell fruit and any of our surplus that isn't needed for cycling back into the system. And while animal husbandry has proven somewhat profitable, I can't see a way to do this long-term (other than passively) without having to heavily cage and corral them, which we've found to be depressing. I have, however, thought of choosing a few selected high-end varieties of chickens, ducks, and/or geese that can provide the same benefits and financial potential, without having to be in great numbers. For example, a few months ago we were able to sell a breeding pair of ayam cemani chickens that we'd raised for $150 for the pair (probably could have sold them for more if we'd been really trying hard). In behavior, egg production, and just about any other way, the ayam cemanis were almost identical to any other breed of chicken. The difference, of course, was that they were rare (and gorgeous, or course), so they sell for considerably more than our $15 chickens. I wouldn't mind doing more of that kind of thing.

Depending on the level of maturity in the system, I'd probably be interested in having a "pick it yourself" fruit purchasing system. I don't think I'd trust people with picking strawberries, vegetables, and other herb layer plants with a system like that, but fruit and nut trees I think could work well. The herb-layer plants could be sold at farmers market, or at my front door, though if it takes a great deal of time on my part, it would need to yield substantial financial benefit to be worth it to me.

I also recognize that making money from the system may be one of the most effective ways to earn enough money to improve/upgrade the system.

Compost and recycling systems?

1) Existing: Animals get food scraps, paper and cardboard scraps go in the fire. Wood is used in building or landscaping, and yogurt, sour-cream, and cottage cheese containers are used for food storage. All plant-based items are either left on the ground (sort of chop-and-drop style) or moved to where they can be eaten by our birds or nourish the ground.

2) Desired: As I mentioned in the garbage section, I would love to get things to the point where almost everything but the toxic stuff are in a closed-loop system—getting used, reused, and finally breaking down to feed future systems. We have a large wood/branch pile from which we take branches and leaves for composting, mulching, and ground-cover. I could probably do well with a wood-mulching tool or machine to get a head-start with our sticks and branches. Heck, I'd cover the whole property with branches if it weren't such a fire hazard. Eventually, I'd like to have enough trees growing so as to not need them to be brought in from elsewhere—especially since I have to be careful not to use chemically sprayed branches on the landscape.

Livestock

1) Existing: Chickens, ducks, and geese.

2) Desired: If I could find a way to free-range them, I'd probably do several other bird species, too, such as quail. I suspect guineas would do alright, but so far our attempts at free-ranging pheasants and peacocks has failed. My experience so far shows me that for me to really feel good about having animals, I have to free-range them. That means I have to fence in annual crops and young perennials, and make sure my numbers of animals stays rather small. A flock sufficient to provide eggs, sales, and some fun learning/husbandry experiences for the kids is really all we need so far. We tried goats, and while they were fun, we couldn't free-range them, because they would eat our trees. We'd also love to have a bee colony or two.

Pets

1) Existing: A ferret. She's the absolute best mouse deterrent we've *ever* had.

2) Desired: Our ferret needs a buddy. She doesn't cost much to feed and maintain, but ferrets aren't cheap to buy. I also wouldn't mind having finches again, living in my garden room. But next time, I can't have them in the same room as an indoor fishpond (poor things). Might one day get another lapdog when our youngest child is old enough to not torture it, but I'm not in a hurry. Especially since it would need to be raised with the birds and taught to leave them alone.

Wildlife enhancement

1) Existing: We get a lot of squirrels, voles, and groundhogs. We've seen gopher snakes, and dozens of small lizards. Pigeons come at feeding time (I might try to set up a wild loft for them). Mice are abundant, and hawks and eagles come through fairly often. Bugs are abundant, but have reduced considerably since we got chickens and ducks.

2) Desired: I would love to have wild ducks show up and mingle/mate with our ducks. We have one duck that is half wild mallard. His mom was a domestic rouen, and a male wild mallard showed up and befriended her. The family who owned the rouen incubated the egg. We got him from them at about a week or two old, and he grew up to be the size and look of a wild mallard. He even flies. We'd love more

wild mixes. I'd also love to have ponds where amphibians show up. I realize with ducks this may never quite pan out, but maybe I can have a small protected pond for that purpose.

Woodlot

1) Existing: None—unless you consider the community-contributed woodpile a woodlot :)

2) Desired: I'd love to have large wood-harvesting trees on the outskirts of the property (which double as wind-breaks and shade trees) so that by the time I'm retired, I don't need to go to the mountains for my wood—I just need to prune enough (a year or so ahead of time) to provide for our wood-burning needs.

Vehicles: (car/truck, farm equipment, recreational equip, Earth moving equipment or other heavy machinery?)

1) Existing: Minivan and commuter car.

2) Desired: A truck with a plow. Also a trailer, for hauling and transporting materials.

Summary

What is the client's vision for the site?

A food forest with as many perennial food growing systems as possible. The more self-sustaining (as in, the plant meets its own needs because of it's location, guild, etc.) the better. I'd love to have a food forest that could be ignored for 100 years, and then afterward found to still be producing hundreds of pounds of food every year. That fruit/nut food forest is my number 1 vision. Beyond that, it would be cool to develop as many energy-producing systems as possible.

If all goes well, I'd love it to be a site where permaculture/sustainable agriculture could be taught.

What are the challenges or limitations that the client has encountered on this site?

The site itself has several challenges, but the number one challenge is finances. We're *way* below the Utah poverty line for our size of family and ages. It appears that this will continue to be the number one challenge. Thus much of the expenses that would be incurred for earthwork machines have to be made up for in physical labor and a shovel. Some edible plants can be purchased on food-stamps, but other types are going to be difficult to obtain unless they can be propagated or otherwise obtained from non-nursery sources. Structures (sheds, etc) that require lumber and building material are particularly challenging to obtain unless they can be built from branches and logs (including those obtained from wood-permit firewood collecting). This also means money-saving energy sources/production could help open the way for financial possibilities in other parts of the system. Presently, propane water heating and electrical utility bills are the biggest utility costs.

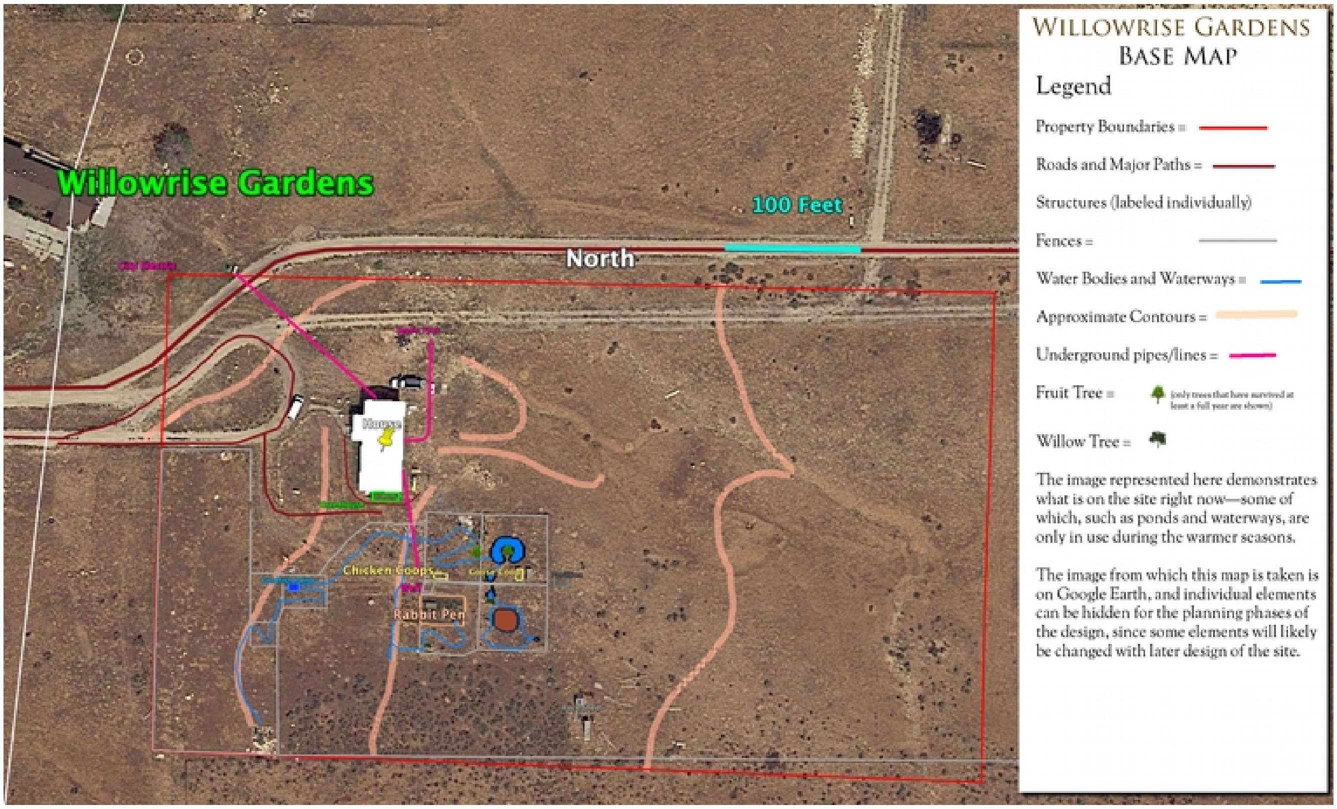
Another big challenge on the site is water. All the water on the property come from our well, which is a good well, but can only pump a limited amount of water at a given time. Plus this water is electricity dependent and depletes the groundwater table.

The only trees on the property have been planted in the past two years since we moved here, so there are no established trees on the property yet. Our success rate for tree survival tends to be under half, so good passive-water harvesting systems for tree establishment are probably going to need to be priority.

What are your goals as the designer for this project?

As a designer, my goal is to prove that a food forest can be established with little financial resources and limited man-power, and that it can be done in an area with limited water resources. A challenge, to be sure —especially for a first project. But if I can do it well, I may be able one day help design properties in poor areas and teach permaculture in third and fourth-world countries.

Base Map



The image represented here demonstrates what is on the site right now—some of which, such as ponds and waterways, are only in use during the warmer seasons.

The image from which this map is taken is on Google Earth, and individual elements can be hidden for the planning phases of the design, since some elements will likely be changed with later design of the site.

Site & Regional Challenges Survey

Chas Hathaway

What are the three biggest cultural / social / economic challenges in your region? Explain.

1. Water is probably the biggest shared concern locally. The debate over water-shares and which towns have a right to the water from one of the local reservoirs. Of course, that concern is rooted in the concern about water in general. Last year, the water table was supposedly lower than it's been in a long time. Living in a desert, everyone is constantly saying we're in a drought. I'm not sure that's really the proper word for it, since the climate is, like I said, a desert. But the concern is the same: will we have enough water for the coming year?

2. The second biggest issue is probably jobs. Those who don't farm full-time have a difficult time finding work, and many drive over an hour to work in larger metropolitan areas, such as Salt Lake or Utah counties. This is so common that people have come to expect it.

3. The third biggest problem (probably) is an extension of the first two: limited economic and agricultural opportunities[3]. While the land lends itself well to traditional agriculture, the limits of water create something of a cap on how much can really be done. Partly as a result, low income is common[4], and though it is considered a historic town and a hub of cultural arts, it struggles to grow in population. In fact, there were more people living in Spring City in 1900 than there is in 2019.[5]

Shasta enjoys a gulp of freshly melted snow

What are the three biggest problems or weak links on your design site? (climate, water, access, vegetation, regulatory, interpersonal, etc)

1. Water. Aside from the 15 inches of precipitation that comes throughout the year, the only water to the site comes from our well. It is pumped via electric well pump, and the same water we use in the house is used in the yard. This consequently depletes the groundwater.

2. Funding. Our annual income is approximately $21,000 per year, a third of which goes to mortgage payments, and most of the rest of which is used to live. While tax returns are helpful, none of the income is sufficient to do any major expense work on the site. Almost all groundworks need to be dug by hand (shovel and pick,

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[3] https://www.usbr.gov/projects/pdf.php?id=188

[4] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

[5] https://www.uen.org/utah_history_encyclopedia/s/SPRING_CITY.shtml

that is), and fences and structures have to be either built of locally obtained free or inexpensive materials or built over many years.

3. Time/Manpower. I put both time and manpower here because they can make up for each other, and since I am working alone, time is a concern. For example, putting in one swale over a length of 200 feet can take up to a month if I want to do it right. With more people doing it, it could be done faster—or with money (concern #2) it can be done even faster than that.

Hand-dug swale

What have been the obstacles thus far in resolving each of these problems?
The biggest obstacles have been the overlap of the three problems. In good rain years, less work is required to maintain plant life, but since water is both scarce and precious, more work has to be done to lay the groundwork to better use what water does come on the property. And since I'm working alone, without money to hire help or heavy machinery, it's difficult to maintain plant life. Depending on the type of plants, and the context of their planting, I have somewhere around a 10% success rate of plants I put in.

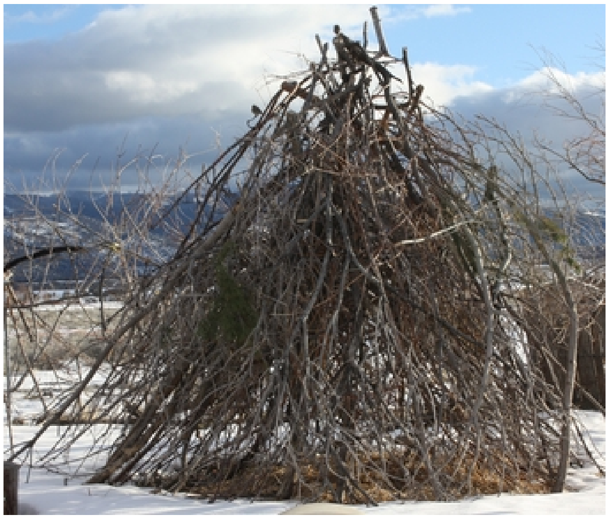
What's been the cost of these problems to date? (ecologically, financially, socially, other)

Ecologically, I am sure we have depleted the groundwater some. In time, this could become a serious issue if our water level drops below the pump line, and ecologically, it would mean the entire region is likely also losing water fast. This is probably the biggest cost overall.

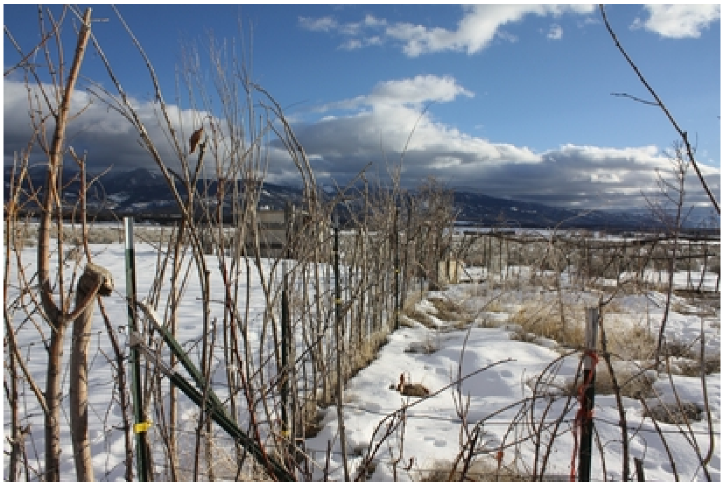
Financially, we've certainly felt some strain, though our default budget for landscaping efforts is $0. We have been able to accomplish many needed projects by building with branches, old fencing, and scrap-wood. The animals don't seem to mind, and the material is doing the trick, but it does take a lot of time to create such structures.

Illustration 1: Hand-dug pond (and when I say hand dug, I mean shovel dug... obviously)

Time has been the biggest personal cost, since it takes a lot of time to built structures, create fences, dig ditches, etc. all by myself. But I'm (for now) willing to put in that time if it can establish a sufficiently working system that will save time and effort later.



Wikiups are built to provide shelter for animals from sun and weather



Branches threaded through 4-foot cattle fencing keeps deer out of gardens

What are the most likely natural disasters to happen in your region?

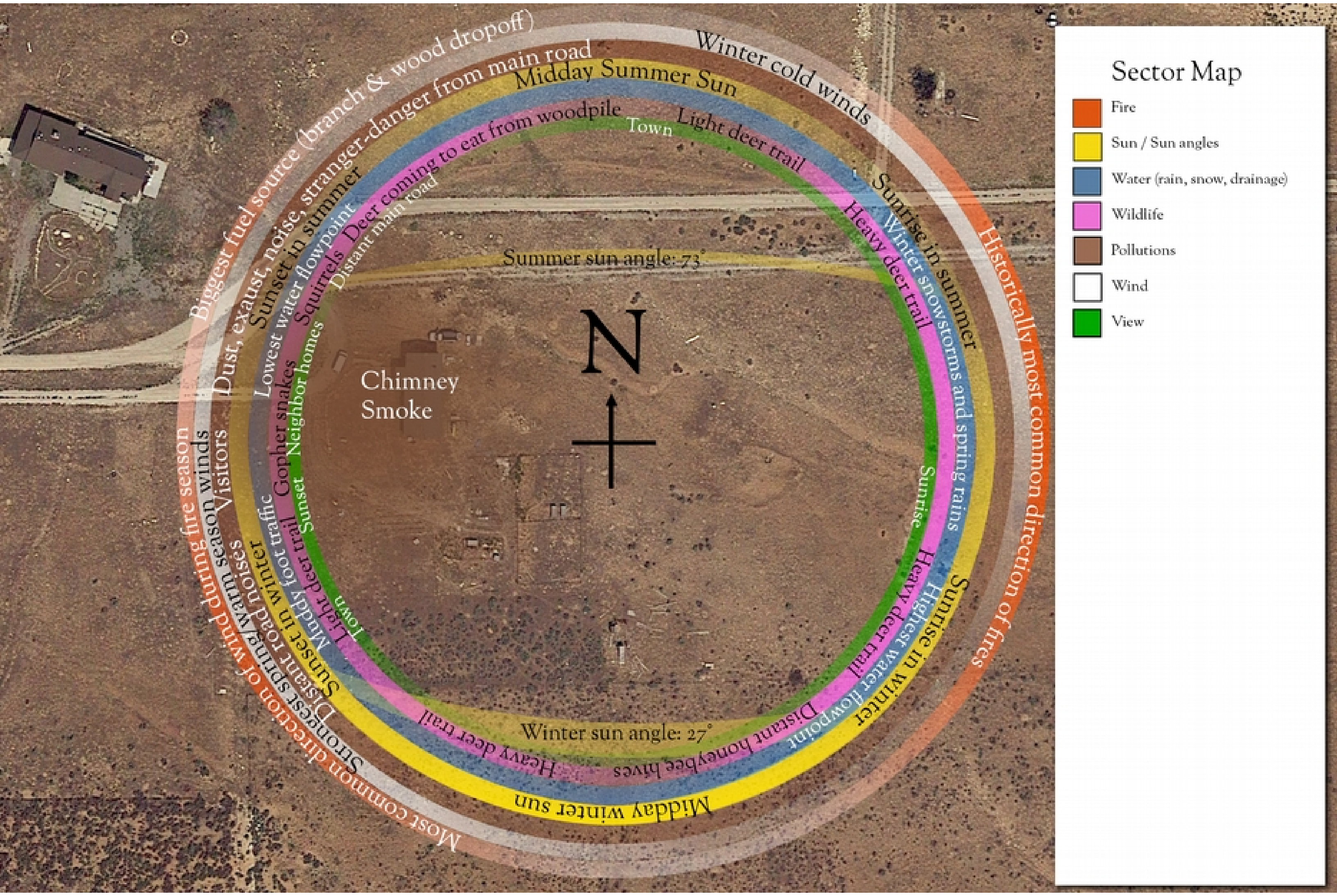
Fire is probably the most devastating local natural disaster. But deep snowfall is probably a more common personal natural disaster, since snow covering our dirt road can make the cars un-drivable, and we have no plow or tractor to clear the ½ mile dirt road to get to the main highway.

What are some strategies for resilience against those natural disasters? Designing a fire-break of some sort around the property may protect against outside fires, and planting fire-resilient plants nearest the house may prevent an on-site fire from catching the house.

Obtaining a plow, truck-with-shovel, or tractor with bucket might be the best way to deal with the risk of being snowed in. I would LOVE to find a way to harvest that ½ mile of snow for future water use, though I may have to check local regulations on that, since most of that road is not on my property.

Sector Compass

For Chas Hathaway's Site Analysis



Fire: The most common fires in the area have come from the mountains to the east of the site, the foothills of which are about a mile from the property. Prevailing winds during the warm season come from the southwest, going northeast. The slope of the site runs from the northwest lowest point to the southeast highest point. The greatest fuel source is the substantial woodpile at the northwest corner of the property. That woodpile is stocked by neighbors and people of the community who have wood and branches to get rid of, so access to the main road is priority with the woodpile.

Sun: Being at 39° latitude, the steepest sun angle in the winter is 27° above the horizon, and the highest sun angle in summer is 73° above the horizon. Where soil is uncovered, drying, baking, and sterilizing of soil is common.

Water: The majority of water that lands on the property comes in the form of snow, though some comes in rain during spring and fall. Water generally drains from southeast to northwest, and there is a 28 foot raise from the NW to the SE, so water generally runs slow across the property.

Wildlife: Squirrels, voles, mice, marmots, and gopher snakes are among the most common animals living on the site itself, but deer, hawks, pigeons and crows/magpies frequent the property. The primary deer paths run from the north center of the property to the southeast corner and from the south center to the northeast corner. Deer especially come for the wood pile, and squirrels live in the woodpile.

Pollutions: While traditional air pollution is not common, fire smoke is abundant in winter (from wood stoves) and the hottest part of summer (wildfires). Generally this comes from all directions, but in winter it is more abundant on site since wood burning is the primary heat source for the home. Dust, exhaust, and noise can sometimes come from the main (dirt) road to the north of the property, and distant truck/vehicle noise from the main town road can come from the west. Also, people (strangers—we have small children) often pass along the main road on the north.

Wind: In spring, the prevailing winds are strongest from southwest to northeast, and in cold winter, from northeast to southwest. The area for over a mile is wide open, allowing wind to easily dry soil surfaces all over the site. Spring is the windiest season, when average spring wind is about 7 miles per hour.

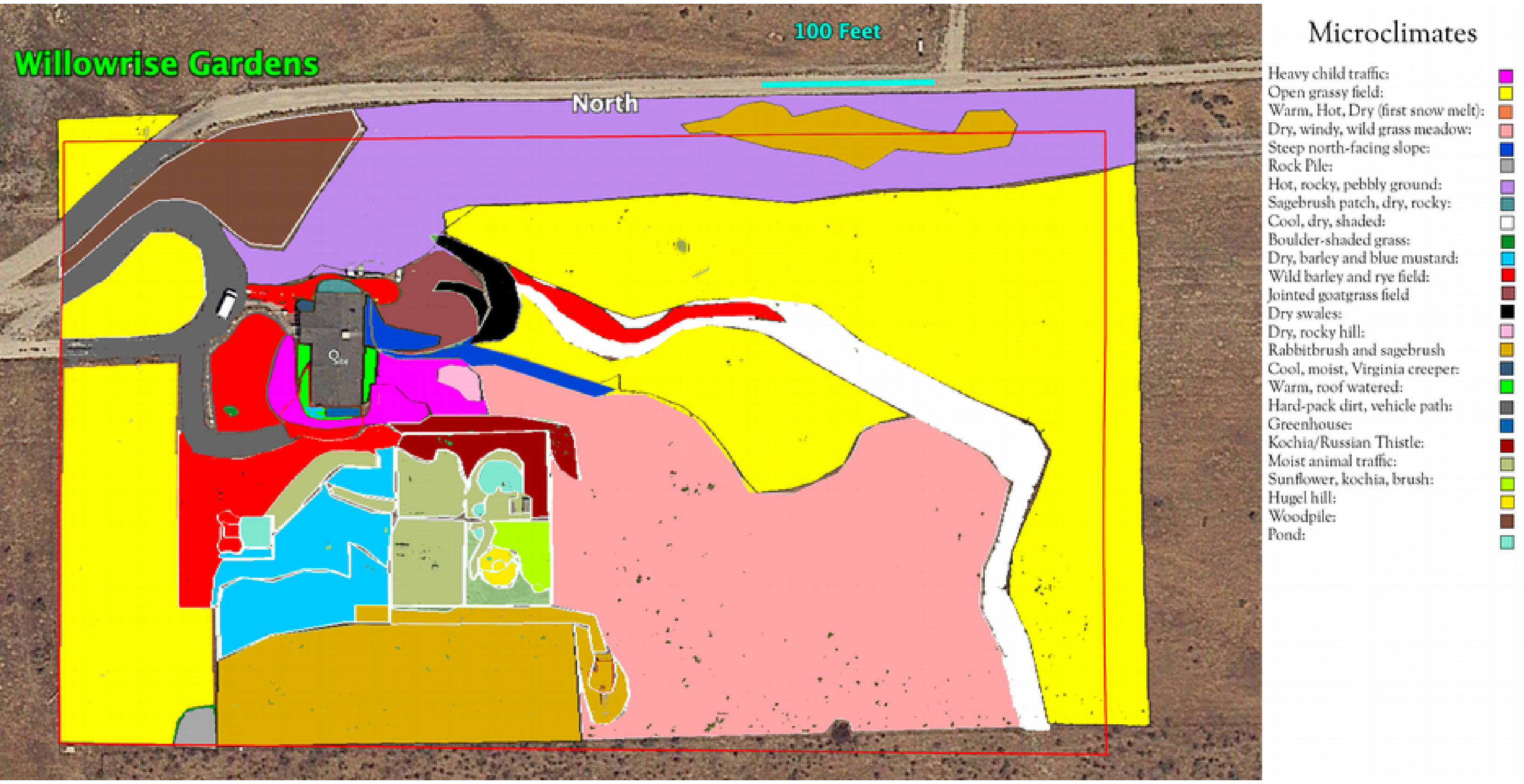
View: The site has a 360° view of the mountains and horizon, all of which is nice, but a view of trees and foliage would be preferable. It would be nice to cut off the view of the neighbor homes and road sounds, as well as have a tree/foliage sound barrier to the distant highway.

Food/Fuel Markets: The closest grocery store is 3.2 miles north of the site, and the closest gas station is 2.1 miles southwest of the site. There is also a hardware store directly across the street from the grocery store. The local church is 1.3 miles from the site, southwest on the main highway, considered the local public emergency meeting place. The hospital is two lots east of the hardware store, 3.4 miles from the site. All of these locations are on the main highway, which can only be accessed from the site via the ½ mile dirt road north of the site running west. Snow is an additional factor as a blockage for vehicles, since the ½ mile dirt road going down to the main highway is *not* plowed by the local government, so becoming stranded in deep snow is a genuine concern.

Microclimates

Chas Hathaway

The following represents the basic microclimates I've identified that exist now. I'm hoping in the near future to design in further microclimates to diversify the landscape.

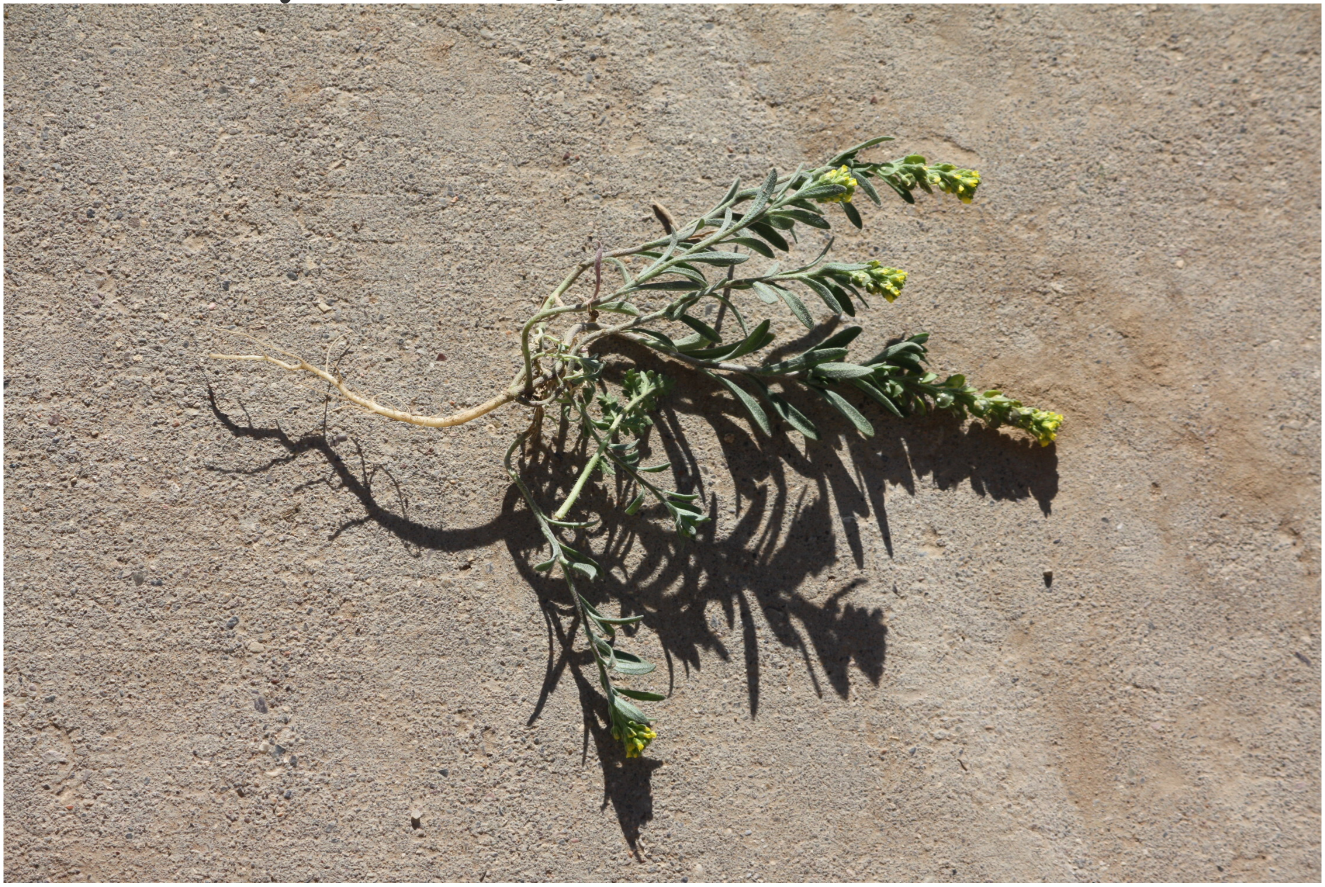

Willowrise Gardens
100 Feet
North
Microclimates
Heavy child traffic:
Open grassy field:
Warm, Hot, Dry (first snow melt):
Dry, windy, wild grass meadow:
Steep north-facing slope:
Rock Pile:
Hot, rocky, pebbly ground:
Sagebrush patch, dry, rocky:
Cool, dry, shaded:
Boulder-shaded grass:
Dry, barley and blue mustard:
Wild barley and rye field:
Jointed goatgrass field
Dry swales:
Dry, rocky hill:
Rabbitbrush and sagebrush
Cool, moist, Virginia creeper:
Warm, roof watered:
Hard-pack dirt, vehicle path:
Greenhouse:
Kochia/Russian Thistle:
Moist animal traffic:
Sunflower, kochia, brush:
Hugel hill:
Woodpile:
Pond:

The most common microclimate is one of dry perennial wild grasses (mostly feral grasses, such as wall barley, rye, and jointed goatgrass), intermixed with wild mustards, rabbitbrush, and kochia. Since approximately ½ of the wind that comes into the site comes from the west, blowing east, everything that is not blocked by the house, boulders, or tucked into ditches or swales is prone to drying. The house does, however provide some climatic diversity via shade, roof runoff, and windbreak.

Five Plants

I've identified what may be the most abundant of the useful plants on the site. These are the ones I consider of greatest use that have sufficient abundance to be confident they will stick around regardless of the changes that take place over time. I had trouble placing images on the pdf and getting it to format right, so I'm doing it in a document form first, and then including the form as a quick reference/comparison chart. Plus edible and useful wild plants is one of my passions, so…

Desert Alyssum, *Alyssum Desertorum*



AKA Desert madwort, or dwarf alyssum, madwort, though madwort is a generic name for all alyssum. Desert Alyssum is a reseeding annual native to northern Africa, Eastern Europe, and western Asia, but introduced and prolific along the western United States and Canada.[6] It was introduced for medicinal purposes.[7] Here it grows in open, sunny, hot, dry areas where the ground is relatively undisturbed. It's a small herb/ground-cover layer flower.

Uses

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[6] USDA Natural Resources Conservation Service, http://plants.usda.gov/core/profile?symbol=ALDED

[7] http://www.cabi.org/isc/datasheet/112171 (rather in depth article on *alyssum desertorum, which compiles all the research sources listed below*)

Primary use: Edible leaves, flowers, and seeds, raw or cooked.

Food: All parts are edible raw or cooked.[8] *Alyssum desertorum* has a rather mild flavor for a brassica. Like all brassicas, the leaves and flowers are edible. I would compare the flavor to a really mild cabbage. Personally, I find the funnest part to eat is the fully dried seeds. To eat the seeds, remove the outer shell by gently rubbing the dry seed-packed stem between your hands and gently blowing away the chaff. Then pop the small tan-colored seeds in your mouth and suck on the seeds. Like the rest of the plant, the flavor is mild, but within 10-20 seconds, the seeds will soften and begin forming a gelatinous glob around each seed. In a short time, they will feel like tomato seeds in the mouth, and if you continue to suck on them, they will get a beebee size gelatinous glob around each seed which is smooth and comfortable in the mouth. Perhaps it's for this reason that in Asia, the seeds have been cultivated for their oil.

Medicinal: The word "alyssum" comes from the Greek words "a-" (meaning without) and "lyssa" which means "madness." The tradition is that it was used to treat rabies, which causes madness. Hence the name madwort, meaning "mad-medicine." [9]

According to Jeff Mosley, Extension Range Management Specialist at Montana State University, desert alyssum was used for curing hiccups, mental illness, and rabies. [10]

Because of the gelatinousness of the seeds, I suspect they could be used to sooth a sore throat.

Ecological: Desert alyssum is eaten by western harvester ants, rabbits, pronghorn antelope, and sage-grouse. Some sources suggest that desert alyssum accelerates soil erosion and takes surface moisture out of the soil, depriving other plants of that moisture, thus preventing the germination of competing seedlings,[11] thus reducing biodiversity in the soil.[12] But from what I can see from reading the few sources suggesting these claims, it appears that the problem is cover cropping and overgrazing, because desert alyssum can live through both. These studies were made on sites that according to the study itself, were only conducted on cover cropped, overgrazed lands. When it is the only crop left, some mistakenly blame desert alyssum for the demise of other crops, though it sounds like it's the animals' eating of the crops (and tromping them in the process) that deplete the crops.[13] If I'm reading that correctly, excessive *Alyssum*

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[8] http://www.americanherbalistsguild.com/sites/default/files/herb_walk_with_brigitte_mars_0.pdf

[9] See https://thenatureniche.com/2014/05/23/desert-madwort/

[10] http://www.msuextension.org/BSSA/assets/docs/Alyssum.pdf

[11] http://www.cabi.org/isc/datasheet/112171

[12] https://eco.confex.com/eco/2009/webprogram/Paper16739.html

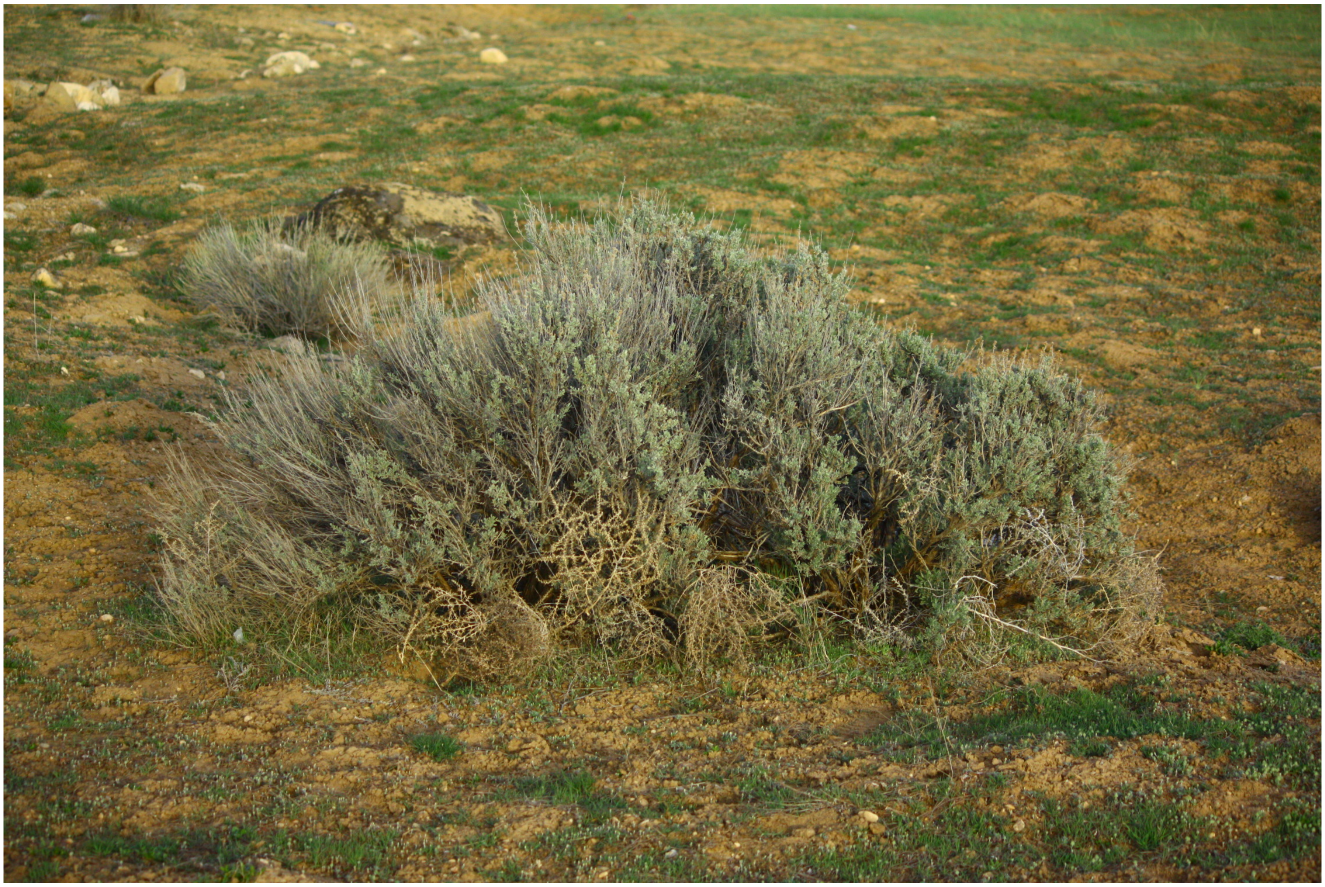
[13] http://www.cabi.org/isc/abstract/19920753644

desertorum (like other drought tolerant wild plants) is an indication that soil has been badly abused by traditional agriculture, and the plant is filling in the gap, preserving the soil from complete sterilization.

Cautions: Though there is no major health risk around desert alyssum, the dried pods can be notoriously annoying when they stick to shoes and socks. Just realize that if the seeds are dry enough to do that, they're also ripe enough to collect the seeds for future use.

Big Sagebrush, *Artemisia tridentata*

Big Sagebrush is a perennial shrub native to North America. On our site, it's in open, hot, dry undisturbed ground, a little more common on a slight slope, and is in the bush/shrub layer.



Uses

Primary use: medicinal tea.

Edibility: The leaves are edible, but ought to be cooked. They can be used as a condiment, but most often, sagebrush is consumed as as tea. The seeds can be eaten raw or cooked. They are said to be oily, but they can be roasted, ground, and/or mixed with water.[14]

Medicinal: Native Americans used sagebrush for many medical treatments. It was used for:

- Antiseptic (a soaking of the crushed leaves or leaves heated in oil is applied to an external wound)
- Disinfectant (a soaking of the crushed leaves or leaves heated in oil is applied to the area)
- Fever reduction (a tea or soaking of the leaves is drunk) by promoting sweating
- Sedative (a tea or soaking of the leaves is drunk)
- Headache (by scent alone, or a tea or soaking of the leaves is drunk)
- Help with digestion (a tea or soaking of the leaves is drunk)
- Constipation (boiled leaves)
- Indigestion (boiled leaves or a tea or soaking of the leaves is drunk)
- Stomach gas (leaves were chewed)[15]
- Flatulence (leaves were chewed or tea is drunk)
- Sore throat (a tea or soaking of the leaves is drunk, or warm leaves are placed on the neck)
- Snakebite (poultice lotion is placed on bite and large amounts of the tea are drunk)
- Pneumonia (a tea or soaking of the leaves is drunk)

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[14] http://www.pfaf.org/user/Plant.aspx?LatinName=Artemisia+tridentata

[15] http://www.herbalpedia.com/SAGEBRUSH,%20COMMON.pdf

- Rheumatoid arthritis (a hot poultice of the plant is placed on the joint)

- Boils (poultice is placed on boil)

- Common cold (a tea or soaking of the leaves is drunk)

- Coughing (a tea or soaking of the leaves is drunk)

- Pain lotion (soaked or boiled in liquid or oil, such as coconut oil)

- Sore eyes (a poultice of steeped or soaked leaves is applied to the eyes)

- Treating dandruff or falling out hair (leaves are soaked and liquid is washed into hair)[16]

- Bug repellant (leaves rubbed on skin)

- Corns (heated into oil to make lotion, then the lotion is applied to the corn)

- Scent mask (rubbed on skin to hide human scent from animals while hunting)

- Foot bath (soaking leaves in hot water and then bathing feet in the water)

- Athletic tonic (tea is drunk to help sweat out impurities)

- Animal sores and illnesses (applied the same as with humans)

As you can see, the most common and useful application of sagebrush as medicine is to make tea of the leaves. Soaking leaves in water (1 part leaves to 32 parts water) overnight, and then discarding the leaves, is one simple preparation for sagebrush tea. For treating external wounds, the leaves can be boiled and then cooled, upon which the water is poured over the wound or the wound is washed in the liquid.

For a simple, quick (though perhaps not as pleasant) tea-like treatment, you can suck on a leaf for a time and then spit it out. If this irritates your stomach, best stick with the more traditional preparations.

Ecological: Sagebrush grows in mountains, deserts, and open prairies, and is a major preventer of erosion, and while it requires full sun itself, it provides a good source of shade for young or shade-needing plants. It can also act as a wind barrier. It is eaten by wildlife year round, including deer, pronghorn, and elk. It is also grazed by agricultural animals such as sheep. It also provides habitat for small animals and birds.

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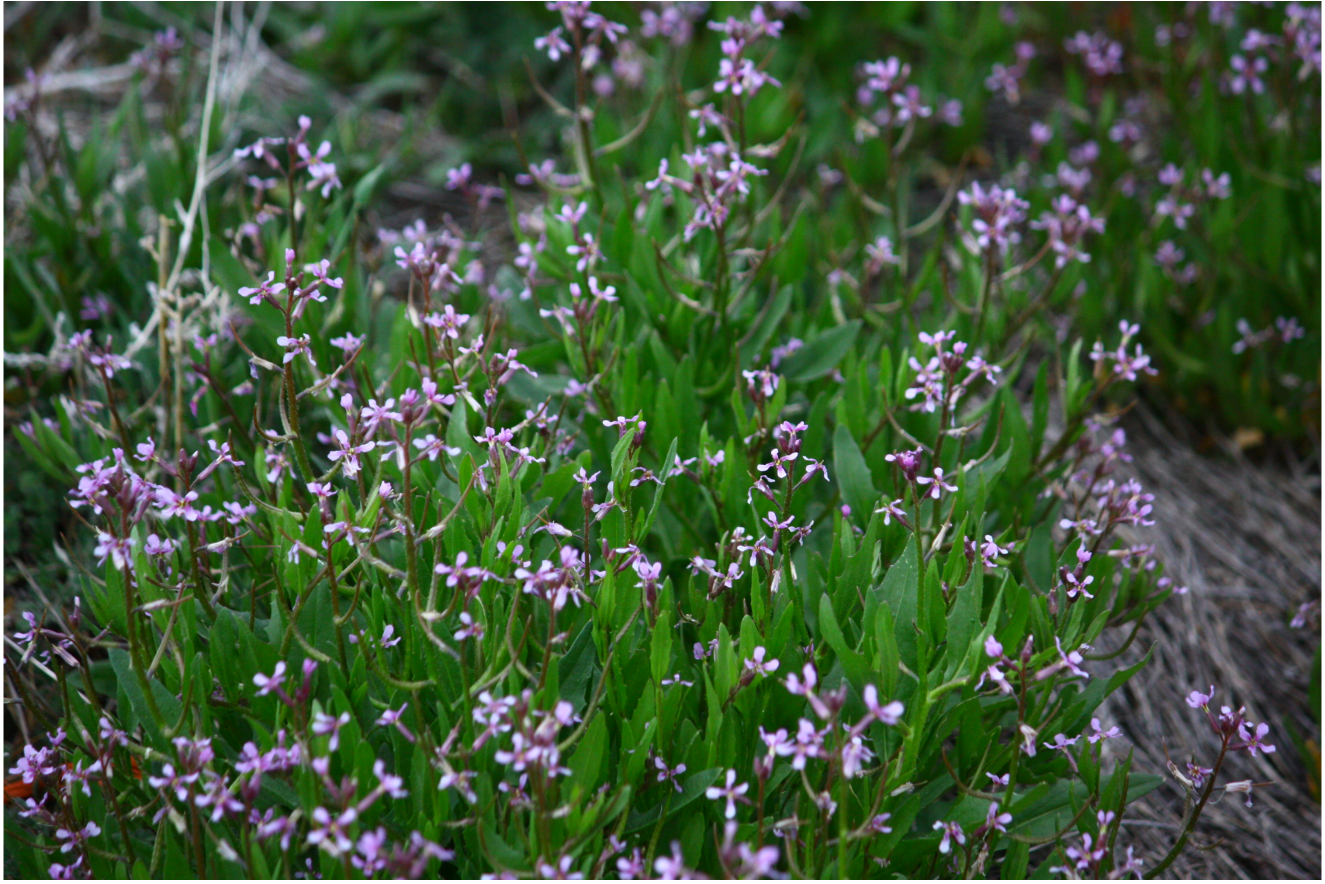
[16] http://www.pfaf.org/user/Plant.aspx?LatinName=Artemisia+tridentata

Practical/Artistic: Sagebrush has a lovely scent, and is often used for its aroma by crushing leaves, especially after rain.[17] The wood can be used for a friction stick for making fire, and the whole plant burns easily, so it can be used for cooking over a campfire, even if still green. Sagebrush can be used in making baskets, dyes, and fiber. The leaves and branches can be burned like incense, making an aromatic smoke.

Cautions: *This plant should not be used while pregnant or nursing. It also shouldn't be used for emphysema or bronchiectasis.[18] Although never found to be toxic, some people with sensitive skin have gotten dermatitis from sagebrush. Some people who suffer from allergies have had reactions from this plant.*

As with using any wild edible for the first time, start small to ensure you don't have a reaction before using the plant in any degree of quantity.

Blue Mustard, *Chorispora tenella*



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[17] http://www.tolweb.org/treehouses/?treehouse_id=4623

[18] http://www.herbalpedia.com/SAGEBRUSH,%20COMMON.pdf

AKA musk mustard, crossflower, and purple mustard. Blue mustard is an annual herb native to Eurasia, introduced to North and South America (unknown years). Here it seems to grow best in open fields among the wild grasses in direct sun, occupying a ground-cover layer in the early spring, but expanding to an herb layer in late spring.

Uses

Primary use: eating raw leaves and pods.[19]

Edibility: As a brassica, all parts of blue mustard are edible raw or cooked.[20] The best tasting parts are probably the fresh leaves and green pods. The leaves and green pods have a vaguely radish-like flavor, and are tasty mixed into salads,[21] soups, sandwiches, and basically anywhere you might use broccoli, kale, radishes, or spinach. The dried seeds are crunchy raw, and have (in my opinion) a musky mustard flavor, and might be able to be used to make yellow mustard, though I haven't tried it yet. They might make a good textural addition to salad, and would probably be good in soup. And while they aren't quite as tasty as desert alyssum seed, the seeds of blue mustard are bigger and a little easier to harvest.

Medicinal: None known.[22]

Ecological: Blue mustard is one of the first greens to show up in the spring, and as an early bloomer, invites beneficial pollinators and insects. The purple flowers over the meadow leave a nice, sweet, wildflower smell in the air.

Lambsquarters, *Chenopodium Album*

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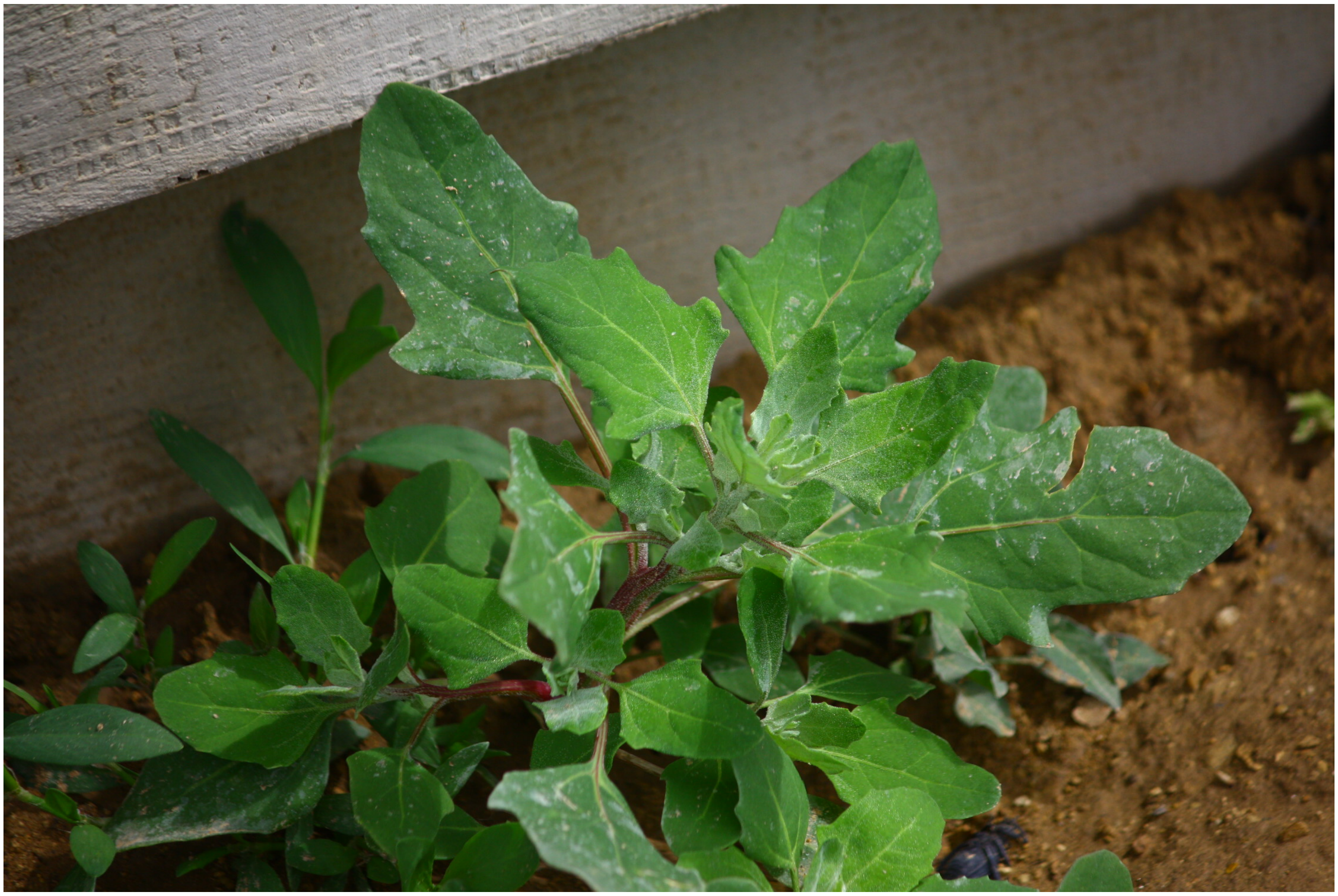
[19] https://thegrownetwork.com/wild-edibles-from-the-utah-desert/

[20] https://pfaf.org/user/Plant.aspx?LatinName=Chorispora+tenella

[21] https://www.backyardforager.com/musk-mustard-chorispora-tenella/

[22] http://www.naturalmedicinalherbs.net/herbs/c/chorispora-tenella=musk-mustard.php



AKA wild spinach. Lambsquarters is a reseeding annual that has both native to North America and introduced varieties (by early American settlers). It seems to grow best in either partial shade or amidst other herb-layer zones, where it is warm and ever so slightly moist. It occupies an herb layer.

Uses

Primary use: eating the edible leaves, raw or cooked.

Edibility:Edible leaves and flowers, raw or cooked. Edible seeds when cooked. Seeds can also be ground for mush.

Also sometimes referred to as wild quinoa, the seeds can be prepared the same way. The leaves are also eaten raw or cooked like spinach. Native Americans used it as a grain crop for centuries. Lambsquarters is among one of the many species/varieties of tumbleweed.

Eat the leaves any way that you might eat spinach (lambsquarters is also often called wild spinach). Great in salads, soups, and pesto, or cooked into recipes calling for cooked spinach.

Seeds can be gathered by shaking the tops in a bag, and they can be prepared by grinding into a nutritious black flour and added to cereal grains.[23] They can also be boiled like quinoa. Either way, the seeds should be cooked. Another method for eating the seeds is to sprout them (which only takes 1-2 days) and eat the microgreens raw.[24] Native Americans often used the seeds for meal in bread or gruel.[25]

Lambsquarters is one of the most nutritious wild edibles. 3.5 oz of raw Lambsquarters leaves provides the following vitamin and mineral percentages of a typical[26] adult's daily needs:

Vitamin A: 232%

Manganese: 39%

Calcium: 31%

Riboflavin: 26%

Dietary Fiber: 16%

Copper: 15%

Vitamin B6: 14%

Thiamin: 11%

Potassium: 10%

Lambsquarters also provides the following Amino Acids:

Histidine 17%

Isoleucine 18%

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[23] Thomas S. Elias and Peter A. Dykeman, *Edible Wild Plants: A North American Field Guide,* (New York, Sterling Publishing Co., 1990), 75

[24] http://www.motherearthnews.com/real-food/seasonal-recipes/lambsquarter-ze0z1412zcgp.aspx

[25] H.D. Harrington, *Edible Native Plants of the Rocky Mountains,* (Albuquerque, University of New Mexico Press, 1967), 69

[26] Based on an average adult weighing 154 pounds.

Leucine	0.35 g	13%
Lysine	0.354 g	17%
Threonine	0.163 g	16%
Tryptophan	0.038 g	14%
Valine	0.226 g	12%

There are more vitamins, minerals, and amino acids in lambsquarters that are under 10% as well.

Comparing Lambsquarters nutrition information to that of spinach shows that for the most part, lambsquarters is significantly more nutritious than traditional spinach.[27]

Medicinal: Though lambsquarters' best use is as a food, it does have mild medicinal uses. Native Americans used lambsquarters to prevent scurvy, and to treat stomachaches.[28] It is also used to treat burns by making a poultice of the leaves and placing it on the affected area. It can also be consumed for intestinal problems.[29] A cold herbal tea can be consumed to treat diarrhea. The poultice of lambsquarters can also be used to treat itchy skin.[30]

Ecological: Lambsquarters attracts butterflies, and other beneficial insects. Lambsquarters is sometimes an indicator species for healthy soil. It's presence indicates that the soil is a pH between about 4.5 to 8.3.

Cautions: Though most sources list the seeds as harmless, Gregory L. Tilford suggests that although the leaves are very nutritious and safe in any quantity, the seeds should only be consumed when cooked and in small quantities. Too much of the seeds can lead to toxic effects.[31] This idea probably comes from the fact that there are saponins in the seed.[32] Others suggest that though the leaves are nutritious, oxalic acid in the leaves means they should also not be eaten in too great of quantities.[33] Because of this, those with kidney stones, gout, or rheumatoid arthritis should probably avoid lambsquarters. There are a couple potentially mildly toxic lookalikes called *Chenopodium botrys* and *Chenopodium ambosioides* that should be avoided. Most other species in the genus are eaten just like Chenopodium album.

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[27] http://skipthepie.org/vegetables-and-vegetable-products/lambsquarters-raw/compared-to/spinach-raw/

[28] http://www.edibleweedsandthings.com/tag/lambs-quarters/

[29] https://extension.usu.edu/weedguides/files/uploads/Chenopodiaceae.pdf

[30] http://www.digherbs.com/lambs-quarter.html

[31] *Gregory L. Tilford, Edible and Medicinal Plants of the West, (Missoula, Montana: Mountain Press Publishing Company, 1997)*

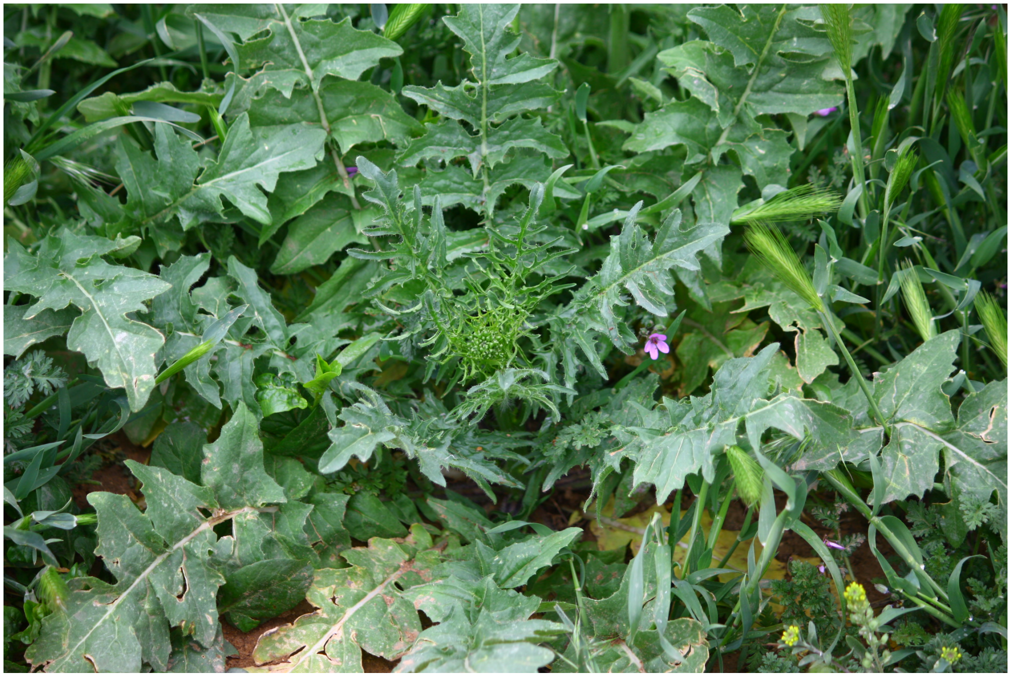
[32] http://www.ediblewildfood.com/lambs-quarters.aspx

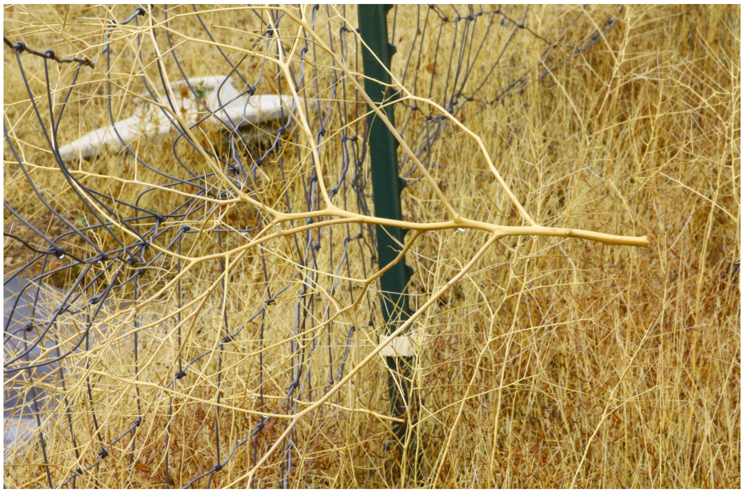
[33] http://www.ediblewildfood.com/lambs-quarters.aspx

Lambsquarters also contains saponins, which are harmless in small quantities, but could begin to become toxic if eaten in great quantities.

Also, though not common, some people are allergic to this plant.[34]

Tumble Mustard, *Sisymbrium altissimum*





Tumble mustard in it's "tumbleweed" stage

AKA tall mustard, tumbleweed mustard, tall sisymbrium, tall hedge mustard, and Jim Hill mustard. Tumble mustard is an annual or biennial tumbleweed, native to the Mediterranean and northern Africa. It occupies an herb layer, though it can reach sizes that put it temporarily in the bush/shrub layer for a time before it begins it's later season tumble. Tumble mustard has a wide range of preferences, and can grow in both dry, open field, and in wet, shady corners.

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[34] http://www.pollenlibrary.com/Specie/Chenopodiur

Uses

Primary use: Edible leaves,[35] flowers, and seeds, raw or cooked.

Edibility: Tumble mustard is a wild mustard, and as such, has edible everything, raw or cooked. To me, the fresh leaves taste exactly like it's cousin, arugula, and can be used and eaten in the same way. The buds, flowers, and pods (which look more like green sticks than pods) are good in salad, soup, sandwiches, or anywhere where a light peppery flavor might be appropriate. The seeds can be eaten plain or cooked. In fact, seeds can be ground and prepared like oatmeal, though I imagine it would be a spicy oatmeal.

Seeds continue to be accessible long after the dry tumbleweed has broken free and tumbled away. They are obtained by snapping the end twig tips, which sends the tiny seeds flying everywhere. The dry tumbleweed can be shaken or banged around in a bag to collect the seeds.

A very closely related (and virtually identical in look and properties) species called Indian hedge mustard (Sisymbrium officinale) was quite popular as a food item among Native Americans. The seeds were collected, traded, and/or sold on markets.

Medicinal: The brother plant, Indian hedge mustard (mentioned above), is said to restore a lost voice, such as after a cold or sore throat. In fact, some call it the "singer plant," because it helps treat loss of voice. In fact, it treats all sorts of throat issues, as well as stomachache.[36] It was prepared by soaking and then drinking the seeds. Perhaps tumble mustard might do the same—but I haven't found anything to verify it. However, the leaves and flowers of tumble mustard are said to be an astringent and can help cure scurvy.[37]

Ecological: Tumble mustard is a food plant for the caterpillars of several butterfly and moth species.

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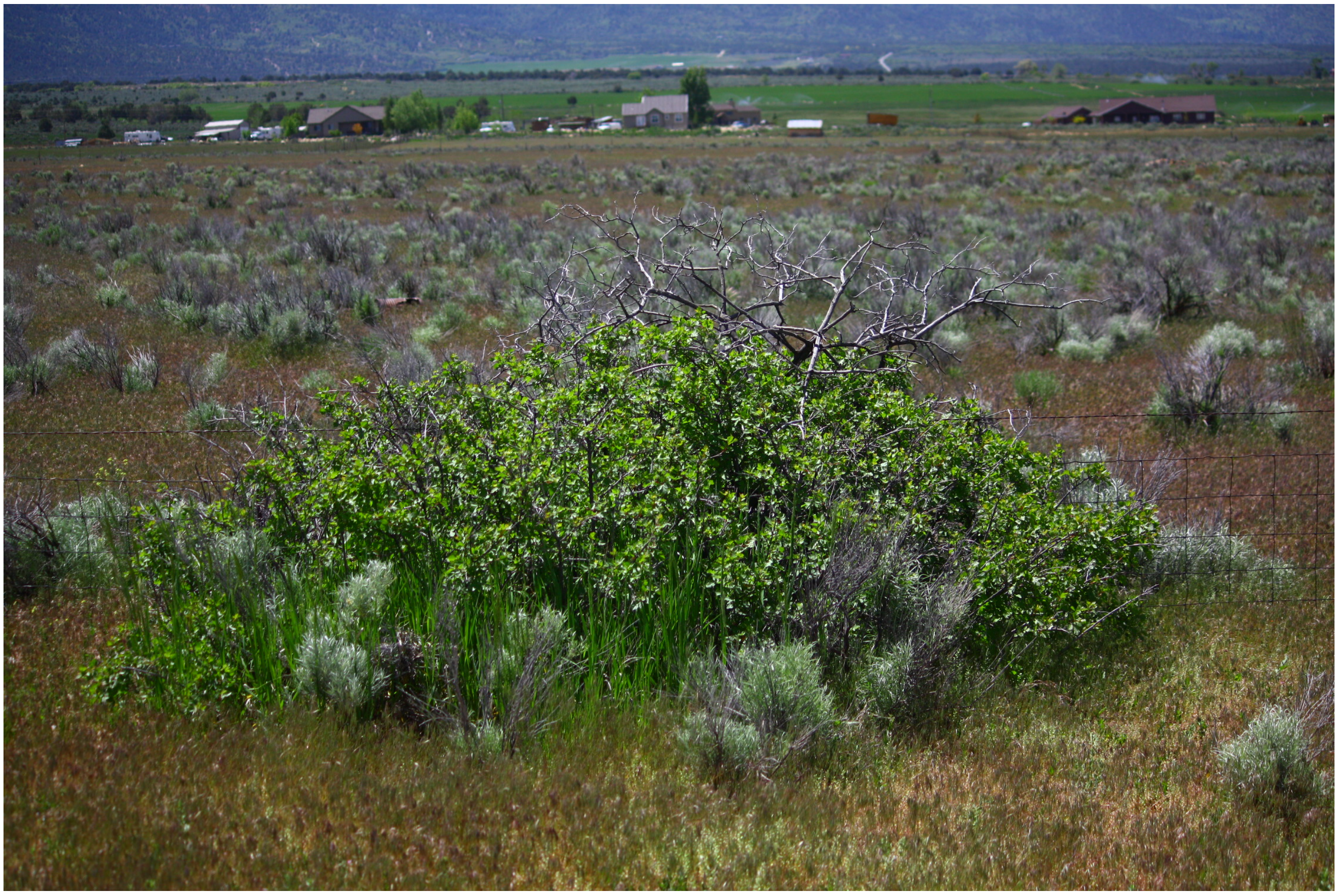
[35] https://pfaf.org/user/Plant.aspx?LatinName=Sisymbrium+altissimum

[36] http://www.pfaf.org/user/Plant.aspx?LatinName=Sisymbrium+officinale

[37] http://www.naturalmedicinalherbs.net/herbs/s/sisymbrium-altissimum=tumble-mustard.php

Practical/Artistic: When matured and finally dry, tumble mustard makes a heroic tumbleweed that makes fantastic craft material. The segments of balsa-like wood can be easily cut and used in crafts appropriate to the size of the piece cut—and every plant hast various sizes of segments of different lengths of light-weight stick.

Cautions: As with other brassicas (mustards), this plant is best eaten mixed with other plants, and not as a primary staple. If eating in great quantity, tumble mustard should probably be cooked.



Rhus trilobata (AKA Skunkbush)

As for a *tree* on the property, there is none, other than the few fruit trees I've planted and am working to get established (but aren't yet). The closest thing to a native tree on the property is a single male *Rhus trilobata* (AKA Skunkbush). If I can get some females on the property, their berries are actually quite good, and are supposed to make a particularly nice mild lemonade.[38] I've tried the berries from bushes down the road and have been pleasantly surprised by their mild, tart flavor, despite their wrinkly, dry look. The skunkbush occupies the bush/shrub layer and grows in open, dry, full-sun fields among wild grasses. Because it sprawls outward, it provides shade for other scorchable plants (including grasses, as seen above).

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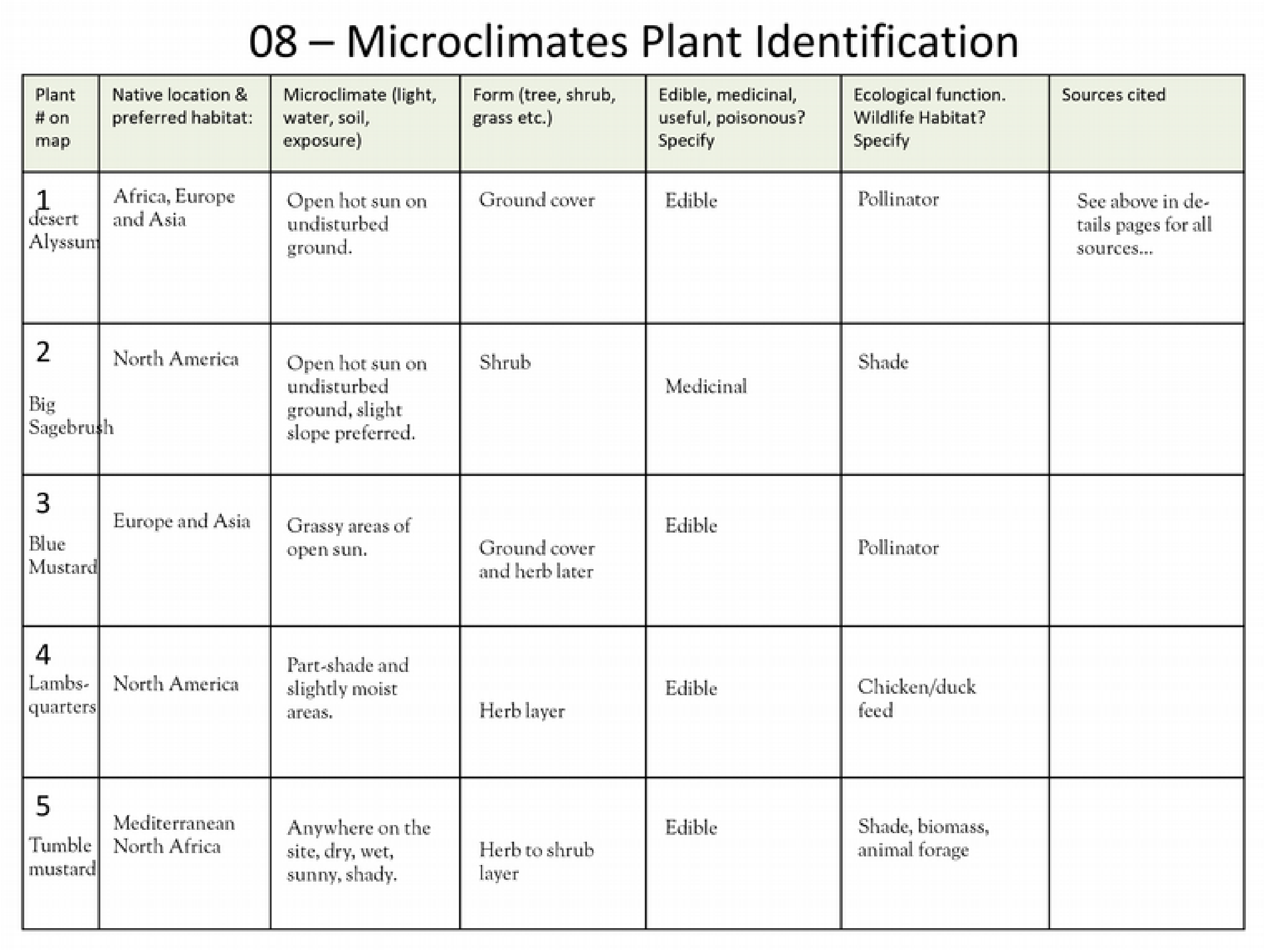
[38] https://pfaf.org/user/Plant.aspx?LatinName=Rhus+trilobata



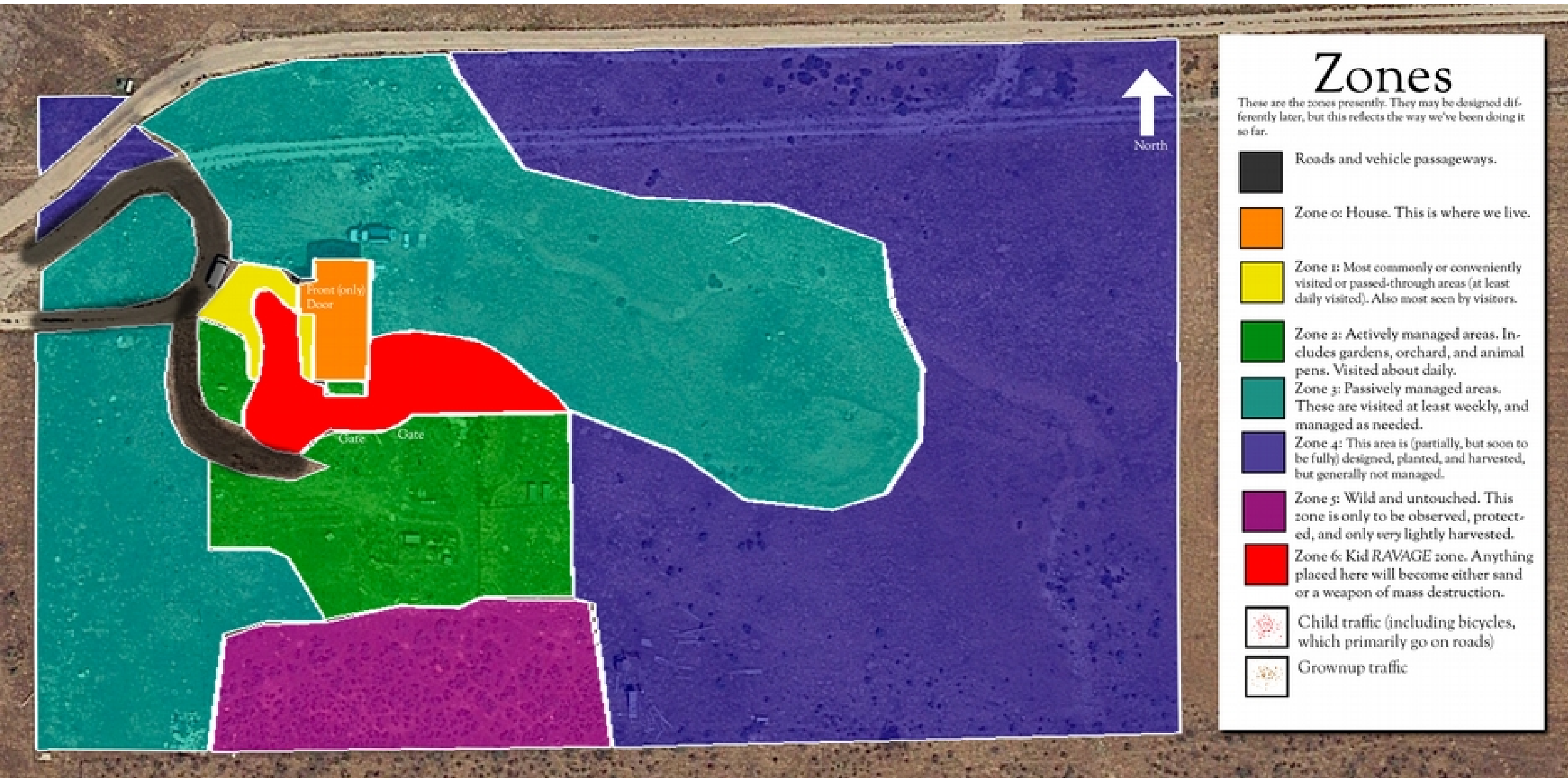
08 – Microclimates Plant Identification

Plant # on map	Native location & preferred habitat:	Microclimate (light, water, soil, exposure)	Form (tree, shrub, grass etc.)	Edible, medicinal, useful, poisonous? Specify	Ecological function. Wildlife Habitat? Specify	Sources cited
1 desert Alyssum	Africa, Europe and Asia	Open hot sun on undisturbed ground.	Ground cover	Edible	Pollinator	See above in details pages for all sources...
2 Big Sagebrush	North America	Open hot sun on undisturbed ground, slight slope preferred.	Shrub	Medicinal	Shade	
3 Blue Mustard	Europe and Asia	Grassy areas of open sun.	Ground cover and herb later	Edible	Pollinator	
4 Lambs-quarters	North America	Part-shade and slightly moist areas.	Herb layer	Edible	Chicken/duck feed	
5 Tumble mustard	Mediterranean North Africa	Anywhere on the site, dry, wet, sunny, shady.	Herb to shrub layer	Edible	Shade, biomass, animal forage	

Current Site Zones

Chas Hathaway

The following is a simple map of the zones of my property (or permaculture site) as they are *currently*. When my permaculture design is complete, they may look differently, but for now this is how it is:


North
Front (only) Door
Gate
Gate
Zones
These are the zones presently. They may be designed differently later, but this reflects the way we've been doing it so far.
Roads and vehicle passageways.
Zone 0: House. This is where we live.
Zone 1: Most commonly or conveniently visited or passed-through areas (at least daily visited). Also most seen by visitors.
Zone 2: Actively managed areas. Includes gardens, orchard, and animal pens. Visited about daily.
Zone 3: Passively managed areas. These are visited at least weekly, and managed as needed.
Zone 4: This area is (partially, but soon to be fully) designed, planted, and harvested, but generally not managed.
Zone 5: Wild and untouched. This zone is only to be observed, protected, and only very lightly harvested.
Zone 6: Kid *RAVAGE* zone. Anything placed here will become either sand or a weapon of mass destruction.
Child traffic (including bicycles, which primarily go on roads)
Grownup traffic

(I've put the foot traffic designators on a second map in order to ensure the clarity of this first map)

Road:

Though not properly a zone, the roads are where the heaviest car and bicycle traffic take place

Zone 0:

This is the house where we live inside.

Zone 1:

On our property, zone 1 is the most frequented outdoor area, *or* the areas that are most convenient to visit everyday. These are usually visited multiple times per day. Because it is so close to the front door (at present our other doors are inoperable or terribly inconvenient, and thus not used, making the front door the only exit or entrance to the house), zone 1 is heavily frequented by our small children, who are both curious and very rambunctious. As such, any design for zone 1 must be either designed with young all-terrain tromp-stomper munchkins in mind, or heavily fenced from their reach (which would probably force it into zone 2, but you get the idea).

Zone 2:

Zone 2 is my most actively managed areas. These are frequented at *least* once a day, but sometimes more. In these areas, I have started planting gardens, orchards, and set up animal areas. These are lightly fenced from the children (which discourages their tromp-stomping, but doesn't perfectly deflect it).

Zone 3:

These areas are passively managed, visited often, but not every day.

Zone 4:

These areas are intended to be designed, planted, and harvested, but otherwise not managed (once set up and established, that is). These will hopefully one day become mature forests, meadows, and/or perennial brush.

Zone 5:

Zone 5 is our untouched, wild, and protected area from which I can observe what the natural environment of this area *wants* do without input from us. It will be available for occasional *light* seed harvesting, or other gentle non-invasive interaction, such as sitting, light passing through, etc, but it's primary purpose is to let nature do what it wants without our influence.

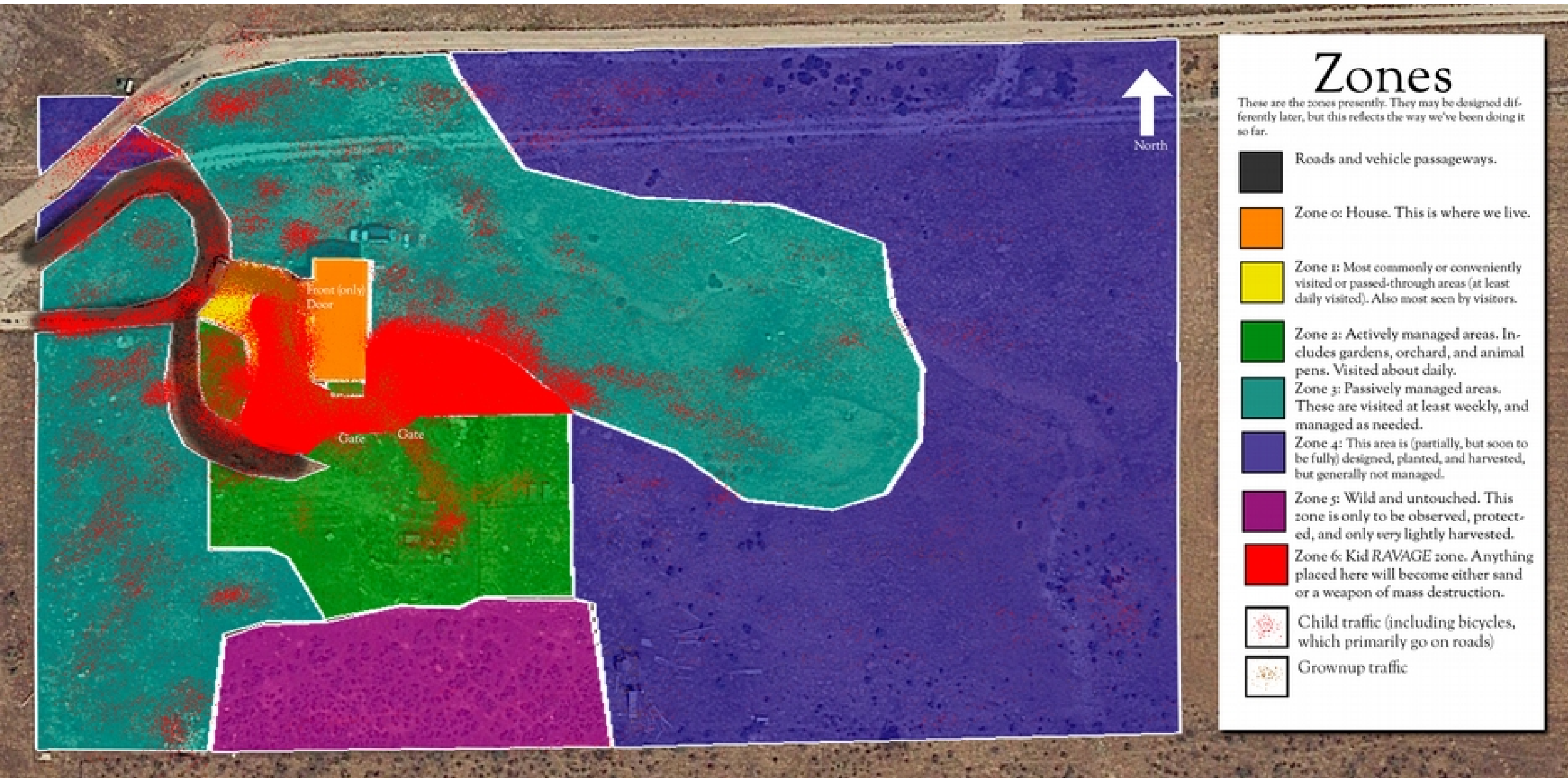
Zone 6:

I had to add this zone for our individual family's needs. Our kids like to interact with the landscape in a hands-on, feet in, shovel, stick, and rock down in, digging, flicking, throwing, splashing, stomping sort of way. This is the kids' most frequented areas. In zone 6, the area has to be either designed *for* destructive children, or *left* for such children.

We work hard to teach our children to respect, love, appreciate, and take care of the landscape, but 4 out of the 6 are 10-years old or younger, and the lessons haven't stuck yet. Not to mention that someday they will likely bring home their own brood of kids, and while I intend to teach all our posterity the value of the earth, it's plants, creatures, and structures, 3-year-olds don't yet get it, and we don't expect them to get it yet. So we'll just design for it.

Foot/Bike Traffic:

On that note, here is a map of the approximate foot/bicycle traffic on the property. My idea was to imagine that I secretly painted red paint on our kids feet to show where they most go in the course of a week or so. This represents my observations. Red is kid feet, and brown is grown-up feet (my wife, me, and any of our adult friends), in order to demonstrate the frequency of the foot traffic on the site.


North
Front (only) Door
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Gate
Zones
These are the zones presently. They may be designed differently later, but this reflects the way we've been doing it so far.
⬛ Roads and vehicle passageways.
🟧 Zone 0: House. This is where we live.
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Child traffic (including bicycles, which primarily go on roads)
Grownup traffic

Water Survey

Chas Hathaway

Questions:

Where does your drinking water come from in your current home?

All of our water (including drinking water, bath, laundry, and toilet) comes from our well.

Where does your wastewater go?

Most of the wastewater goes into a septic tank. Some of the laundry water goes into the backyard as greywater.

What is the record 24 hr rainfall for your design site?

The closest records I can find to a record rainfall is in Ogden, Utah, 146 miles away, and their record in a 24-hour period is 8.40 inches[39] of rain (Sept 7, 1991). That said, Ogden's rainfall average is 20 inches, while ours is 15 inches.

What is the average 5-year 24 hr rainfall event?

I can find no records of year-by-year 24-hr rainfall events from which to take an average for my area, or even state.

What are the roofing materials on your design site (if any)?

Plywood and asphalt shingles.

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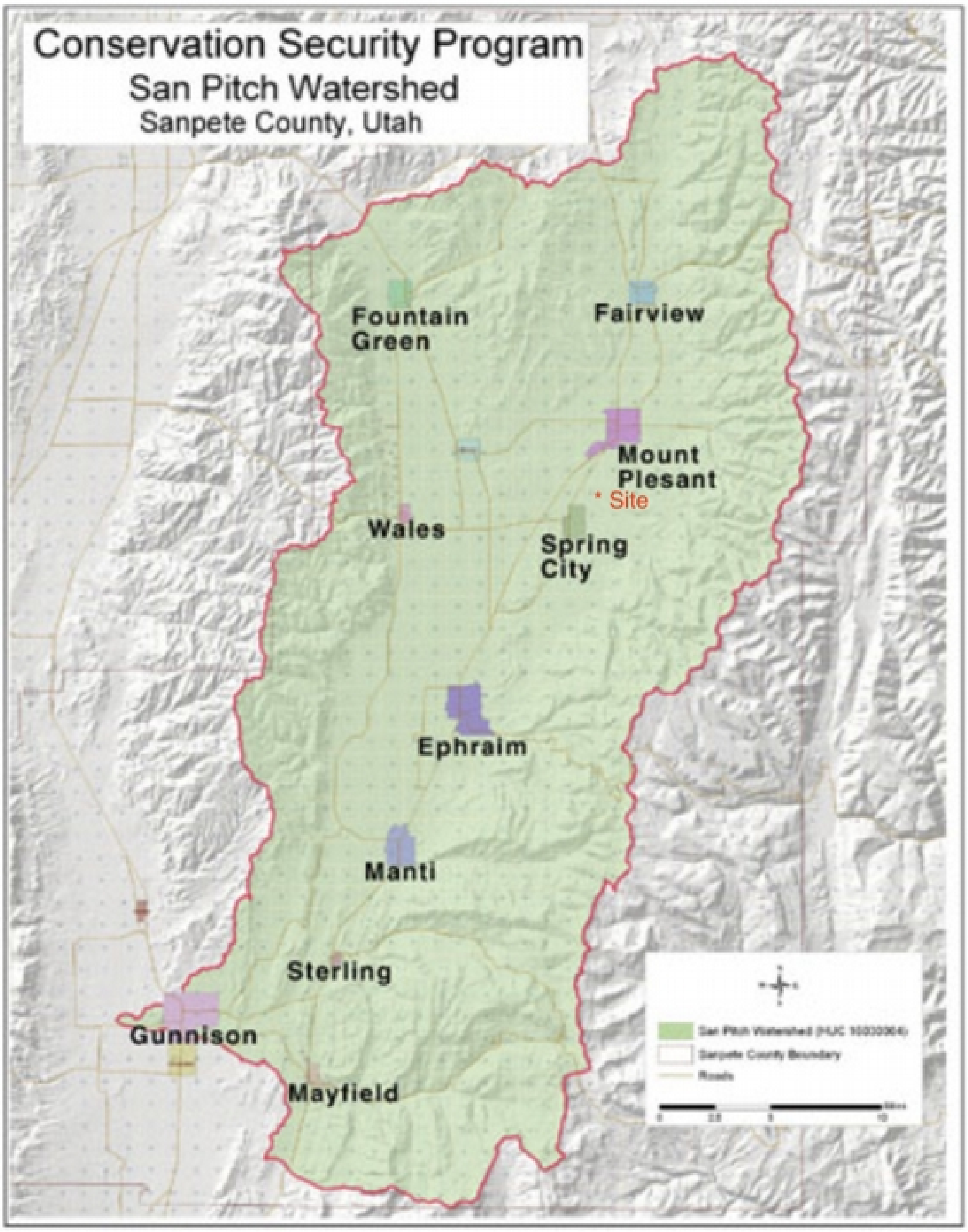
[39] https://www.heraldextra.com/news/local/heating-up-weather-records-set-in-utah/collection_97101096-3efd-55ec-824d-cf7921f0c5a9.html

Watershed Map

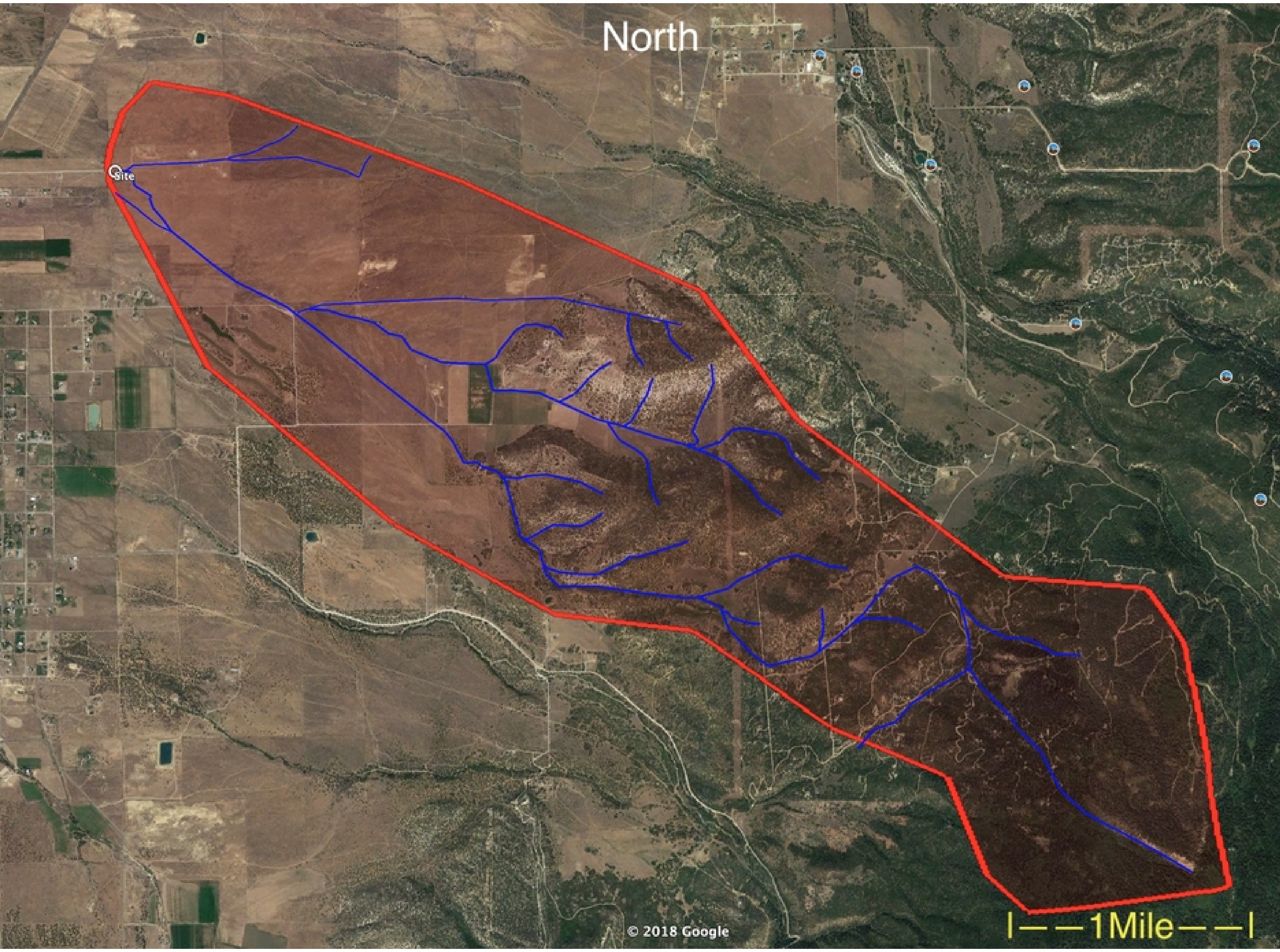
This is the San Pitch Watershed, represents the largest local watershed. The watershed boundary is represented by the red line.

The site is indicated by the red asterisk.

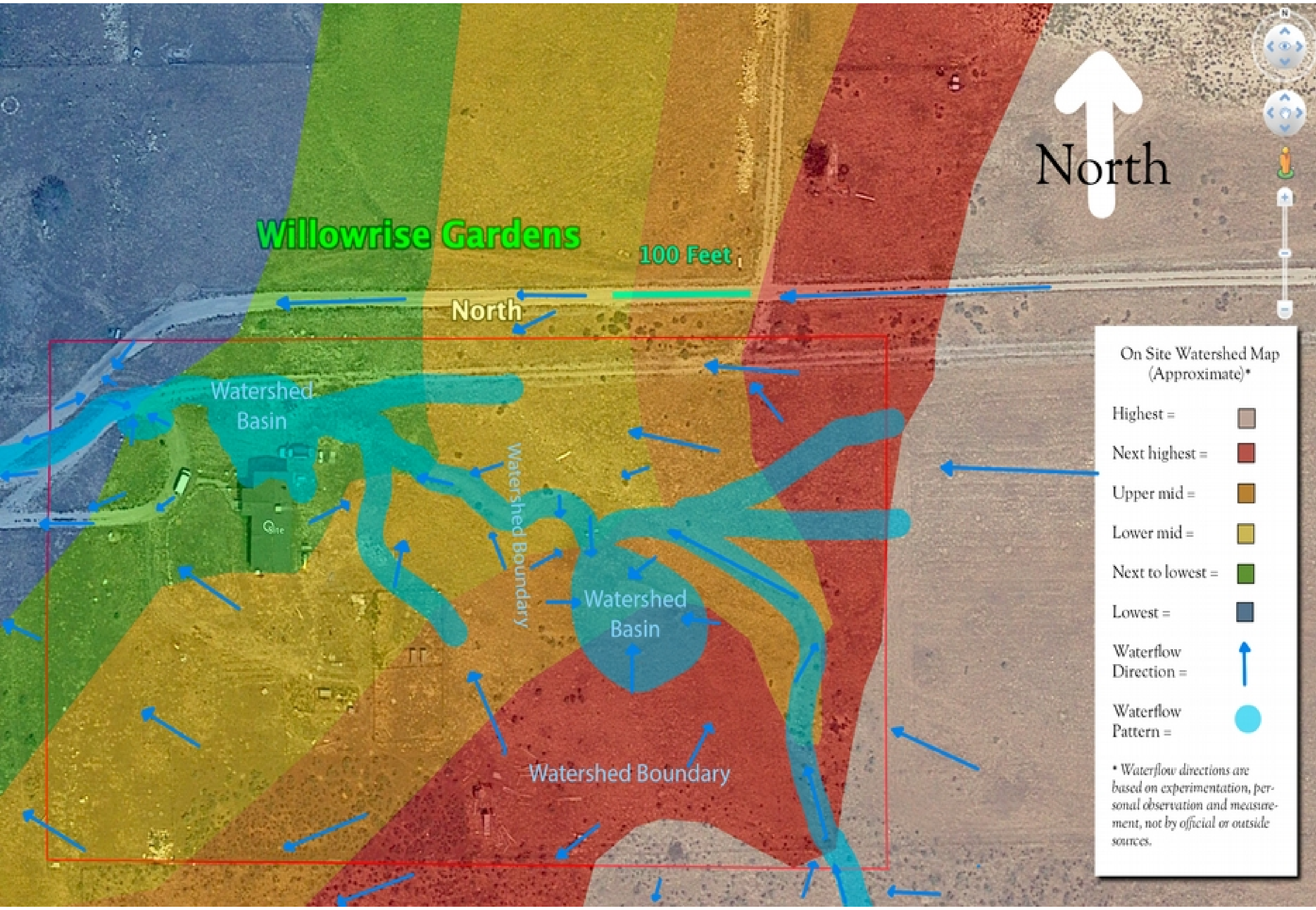


And here is the portion of the watershed that most effects the site.

The red line indicates watershed boundary in the sense that it's the zone beyond which, water will not reach the site.



And here is the water flow of the property itself:



The water flow entering from the southeast corner could (in a flood) pull water from outside the site into the watershed basin just east of the center of the site. From there (if it filled up) it would flow further to the west and potentially flood the house. I have recently added swales halfway between that first basin and the second by the house.

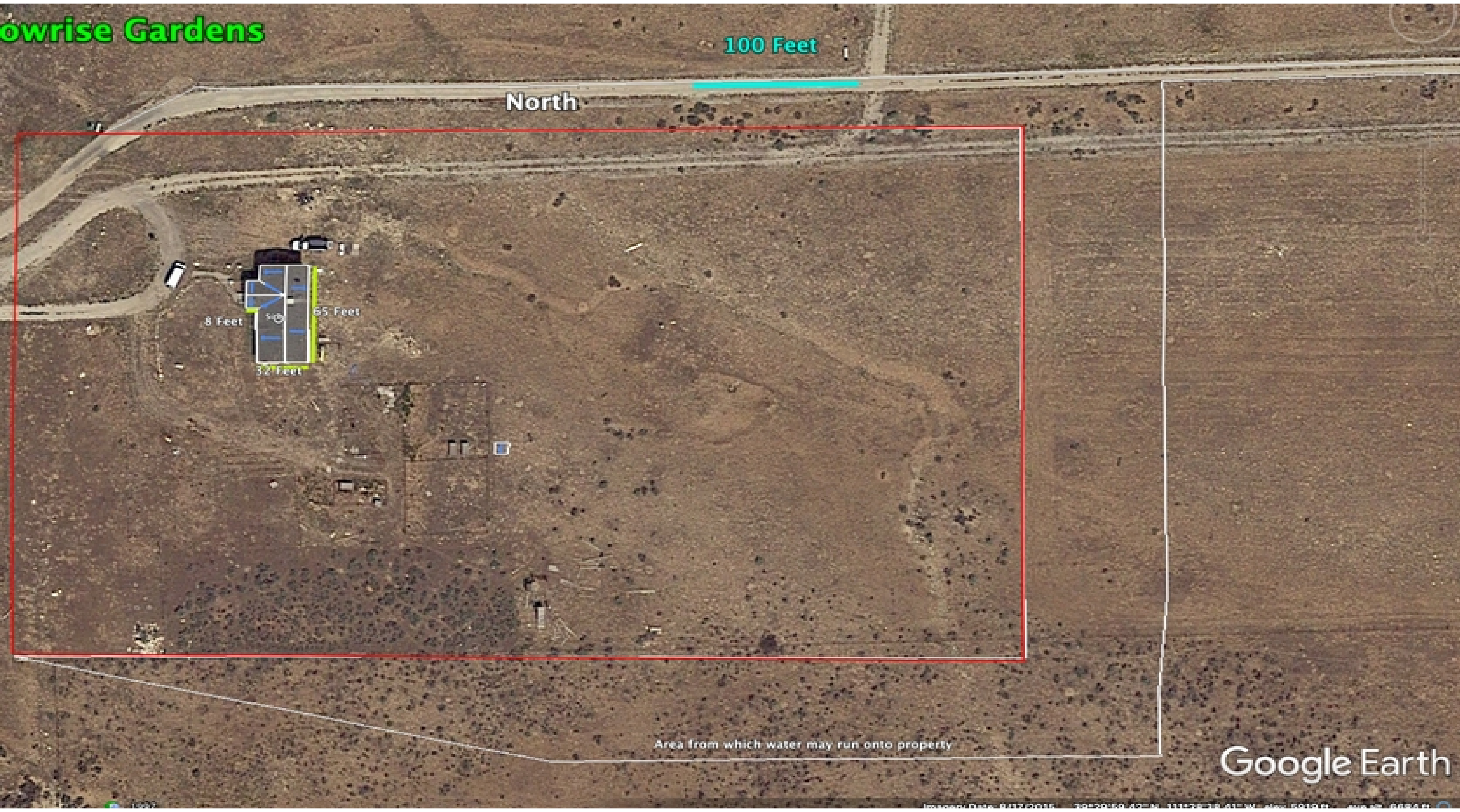
That said, even the wettest days/years on record would not have provided enough water to flood the property at that level (water pouring down the water flow from outside the property, fill the basin, then continue on), though water collecting in that low watershed basin alone *could* cause minor house flooding.

Site Water Flow Analysis

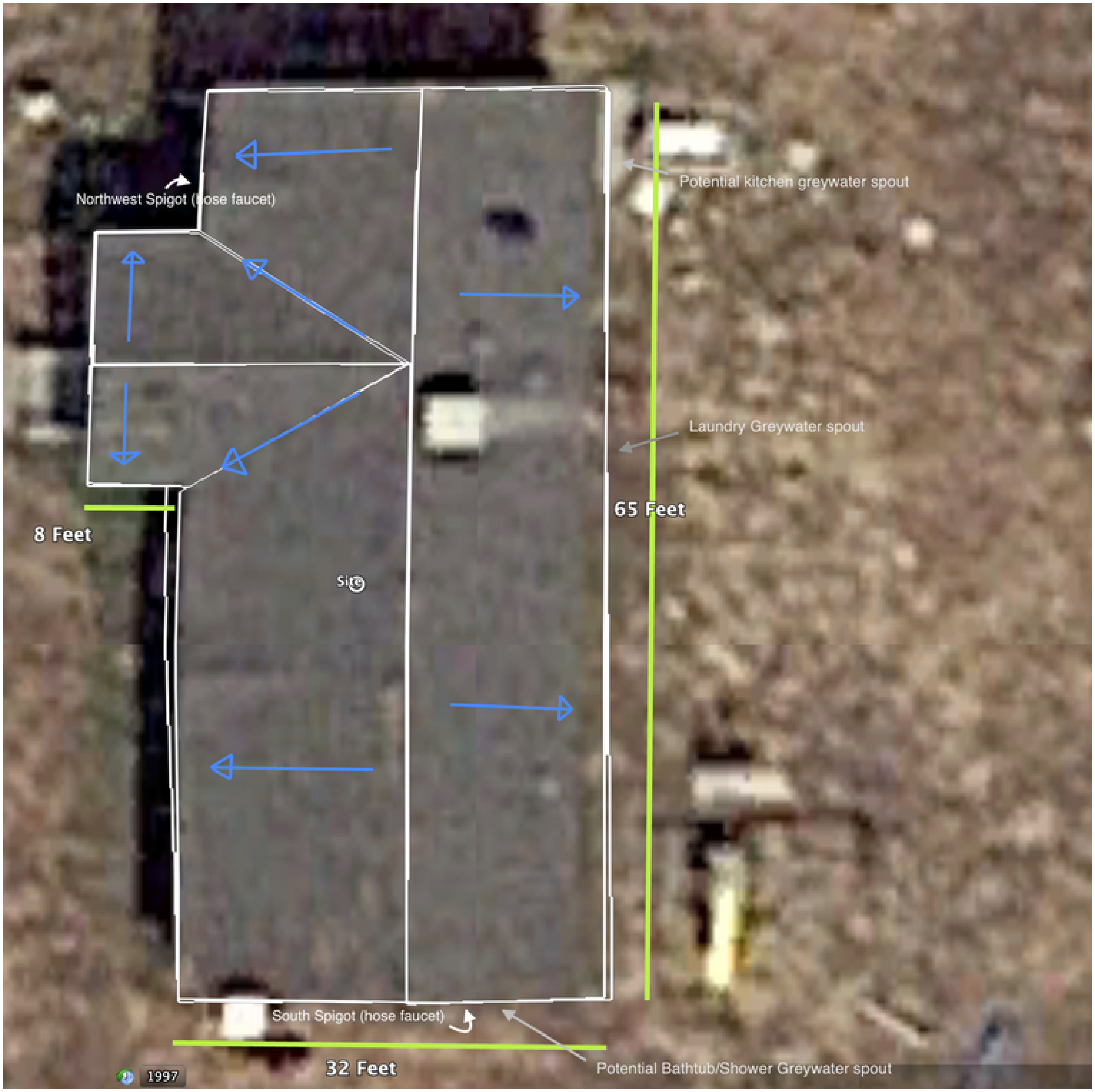
Maps and Descriptions:

1. Water enters the site from above (obviously) but also from the southeast, traveling northwest.

2. Water exits the site to the west, mostly northwest.



3. The house (thus roof) is near the northwest corner of the site, and the water flow across a good part of the property flows toward the house. The north end of the house is at one of the lowest points on the property. At present, there are no rain-gutters or spouts on the roof at all, so all water rolls off the roof directly.


Northwest Spigot (hose faucet)
Potential kitchen greywater spout
Laundry Greywater spout
65 Feet
8 Feet
Site
South Spigot (hose faucet)
Potential Bathtub/Shower Greywater spout
32 Feet
1997

4. At the east center of the house, we have installed a greywater spout for the laundry washer. It is not tied into the piping of the house plumbing, but is a single pipe poking out of the back of the house to which we hang the out-spout of the washer. It *may* be possible to create a similar spout on the south center of the house from which shower and/or bath water may flow. Similarly, a greywater spout could be installed from the kitchen sink going out near the northeast corner of the house.

5. The only two external spigots are at the south center of the house and the northeast corner (but west side) of the house. These are the hose hookups, and they get water from the house' main well pump.

6. The only impermeable surface besides the roof of the house is an 8X8 foot pavilion near the center of the property. It is pretty close to flat, perhaps even a little warped, so snow runoff goes both to the south and to the north, though rain tends to roll off in the south.

7. The general direction of waterflow into and out of the property is from the northeast to the southwest, in a direction of slightly more west than north.

8. There are no natural water features on the property, but I clogged all the drains in an old hot-tub to make into a fishpond. I would estimate it to be about 300 gallons. I could likely install more of these if necessary, as our local classifieds ads often have ads for "free broken hot tub." In addition, I did create a 20x20 pond for our ducks and geese where about half of that space is taken up by a peninsula that allows me to be able to reach anywhere on the pond (for catching our ducks, etc). There is a small apple tree (a very happy one, I might add) growing in the peninsula). It is unsealed, so I have to fill it to keep it full. That said, when full, it holds water for about a week.

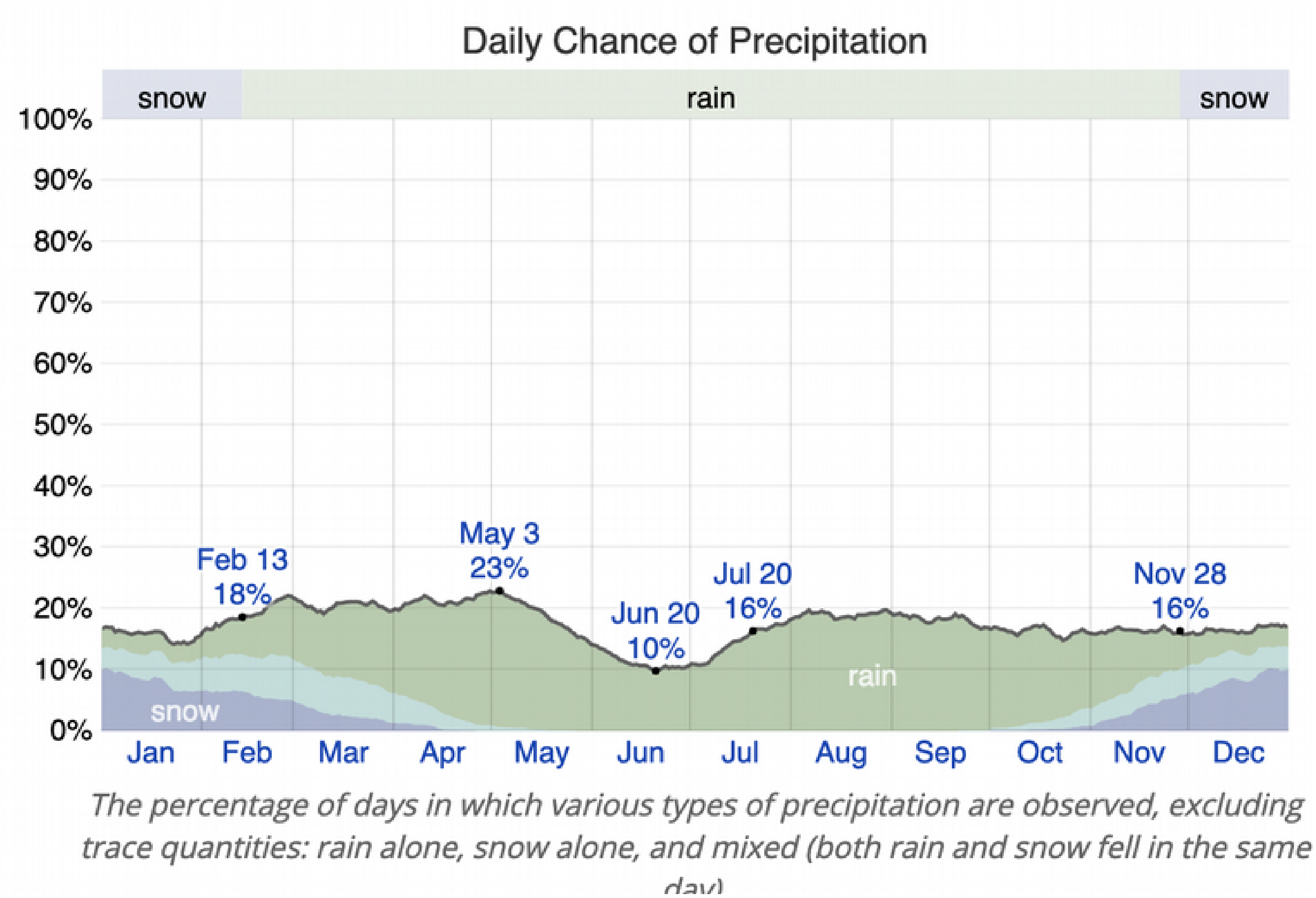
If you look close, there's a goose nesting just beyond the pond. Our geese are great moms, and completely raise their own goslings.

9. In line with our general slope direction, our contour lines tend to run from northeast to southwest, though more north to south than east to west. I've used an A-frame to find the contours from one end of the property to the other, marking it as I go with a ditch (which is a single shovel scoop of dirt's depth), making a temporary micro-swale to indicate where swales might go if I choose to dig them later. The indicators on the map show their approximate location.

10. *****Well location

Charts:

11. Chance of precipitation by month:[40]



12. Area of entire site: 217,800 square feet, or 5 acres. (613 x 355 feet).

13. There is approximately 87,000 square feet of land upslope of the property that could potentially run water onto our site. Though little of this will run overland onto the property (the runoff flowing down the road comes to mind), some may still penetrate underground.

14. Average yearly rainfall: 15 inches

15. I can find no source of information giving the amount of rain that falls in a 100-year flood for this area *locally*, but Ogden, Utah, the closest town to which I *can* find record of amount of rain in a 24-hour time records 8.5 inches of rain in one day.

16. Runoff coefficient for asphalt shingle roof: 0.75—0.95

Runoff coefficient for corrugated aluminum roof: 0.95

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[40] https://weatherspark.com/y/2661/Average-Weather-in-Spring-City-Utah-United-States-Year-Round

In one year, the house roof runs off ~15,553.5 gallons of water per year, and the pavilion runs off about 568.5 gallons. That in total is 16,122 gallons of water collection potential per year.

17. The total square footage of the house and pavilion combined is 2,276.

18. Total rain falling on the entire site in an average year: 2,036,430 (~2 million) gallons [41]

19. Total rain falling on site in a 24 hr 100 yr rain event: based on the approximate 8 inches of rain record in Utah in one day, the amount possibly falling on the property on that day would have been 1,153,976.5 gallons (About 3 olympic swimming pools' worth of water). That said, it was likely less than that in this area, and I can find no source for a 100-year flood event for my area. This is the closest I could find. Still, it gives a ballpark number to prepare for.

20. According to our slope and soil type[42], the land's coefficient is about .42, making the runoff volume draining onto the site 341,649 gallons per year.

21. Assuming we don't do anything to slow or catch our water, 855,300.6 gallons a year can run off it.

22. Again, assuming we don't do anything to slow or catch our water, 2,036,430 gallons could run off it in a 24-hour 100 year storm event.

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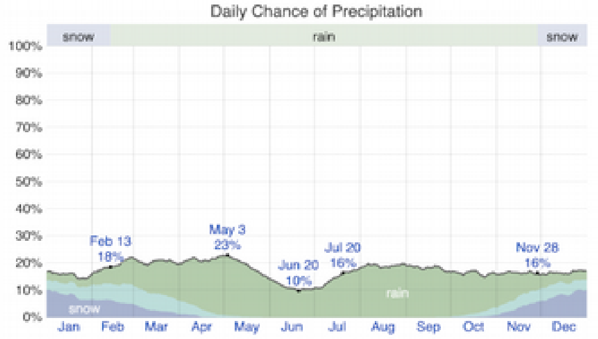
[41] Here's a handy rainfall-to-gallons calculator: https://water.usgs.gov/edu/activity-howmuchrain.php

[42] https://www.brighthubengineering.com/hydraulics-civil-engineering/93173-runoff-coefficients-for-use-in-rational-method-calculations/

12 – Site Water Flow



The percentage of days in which various types of precipitation are observed, excluding trace quantities: rain alone, snow alone, and mixed (both rain and snow fell in the same day).

Convenient conversions

Imperial:
1 inch = .083 feet
1 cubic foot = 7.48 gallons
1 acre foot = 325,852 gallons

Metric:
1 hectare = 1000 square meters
1 cubic meter = 1000 litres
1 megaliter = 1,000,000 litres

A.Total area of site (in square feet, square meters, acres, or hectares)	**B.** Yearly average rainfall (in feet or meters)	Total rain falling on site in average year (**AxB=**) ***Imperial:*** *Multiply by 7.48 for gallons.* **Metric:** Divide cubic meters by 1000 for litres.
217,800 Square Feet	1.25 feet	2,036,430 (~ 2 million gallons)

A.Total area of site (in square feet, square meters, acres, or hectares)	**B.** 100 Year 24 hr rain event (in feet or meters)	Total rain falling on site in 100 Yr 24 hr event (**AxB=**)***Imperial:*** *Multiply by 7.48 for gallons.* **Metric:** Divide cubic meters by 1000 for litres.
217,800 Square Feet	.708333 feet (closest found)	1,153,976.5 gallons

Total area of land draining onto site (in square feet, square meters, acres, or hectares)	Yearly average rainfall (in feet or meters)	Total runoff volume draining onto site (**AxB=**) ***Imperial:*** *Multiply by 7.48 for gallons.* **Metric:** Divide cubic meters by 1000 for litres.
87,000 square feet	1.25 feet	813,450 gallons

Location	**A.** Area (in square feet or square meters)	Material	**B.** Yearly average rainfall (in feet or meters)	**C.** 100 year maximum 24 hr rainfall (in feet or meters)	**D.** Runoff Coefficient of surface	Yearly runoff volume (**AxBxD=**) in cubic feet or cubic meters. ***Imperial:*** *Multiply by 7.48 for gallons.* **Metric:** Divide by 1000 for litres	100 year maximum 24 hr rainfall volume (**AxC=**) ***Imperial:*** *Multiply by 7.48 for gallons.* **Metric:** Divide by 1000 for litres
Roof Area 1	407 sf.	Asphalt	1.25 feet	.7 feet	.75	2,854 gallons	2,131 gallons
Roof Area 2	851 sf.	Asphalt.	1.25 feet	.7 feet	.75	5,967.5 gallons	4,456 gallons
Roof Area 3	960 sf.	Asphalt.	1.25	.7 feet.	.75	6,732 gallons	5,385.5 gallons
Impermeable Area 1	64 sf.	Aluminum	1.25 feet.	.7 feet	.95	568.5 gallons	455 gallons
Impermeable Area 2							
Impermeable Area 3							

Soil Map and Tests

Chas Hathaway

According to the Web Soil Survey website, the soil on the site is PDC, or Pavant-Doyce complex, 2 to 8 percent slopes. From what what I can understand, Pavant is at 4-8% slope, and Doyce is at 2-4% slope.

1. The site's farmland classification is: Not prime farmland

2. The site's typical profile is:

    Pavant:

        Ap - 0 to 7 inches: loam

        C1 - 7 to 13 inches: clay loam

        C1ca - 13 to 17 inches: clay loam

        C2cam - 17 to 29 inches: indurated

    Doyce:

        A1 - 0 to 10 inches: loam

        B2t - 10 to 20 inches: sandy clay loam

        C1ca - 20 to 32 inches: sandy clay loam

        C2ca - 32 to 44 inches: stony sandy clay loam

        C3 - 44 to 48 inches: loam

        C4cab - 48 to 60 inches: stony loam

3. The site's drainage is:

    Pavant: 10 to 20 inches to petrocalcic

    Doyce: More than 80 inches

4. The site's depth to bedrock or restrictive feature is: More than 80 inches

5. The site's depth to water table is: More than 80 inches

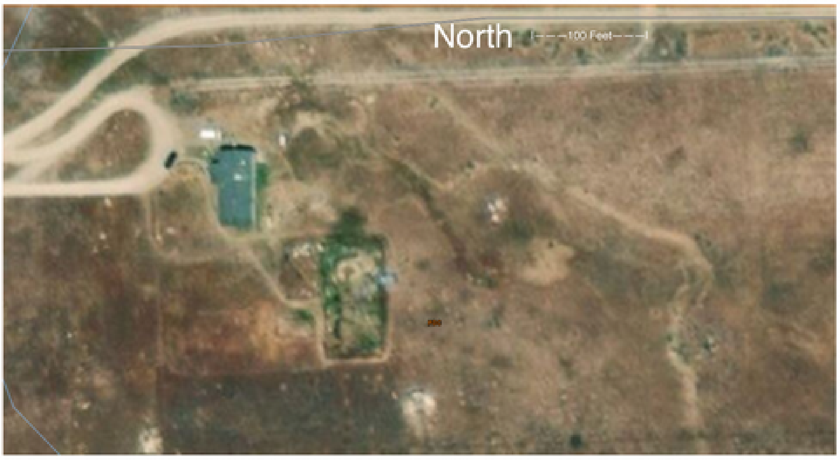
6. The frequency of flooding is: None

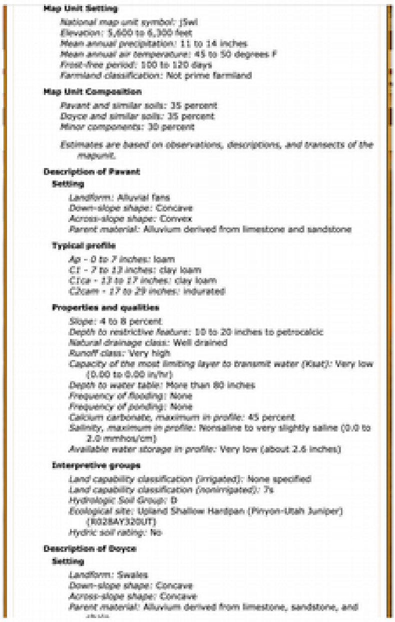
7. The available water storage in profile is:

Pavant: Very low (about 2.6 inches)

Doyce: Moderate (about 8.7 inches)

8. The hydric soil rating is: No





Map Unit Setting
National map unit symbol: j5wl
Elevation: 5,600 to 6,300 feet
Mean annual precipitation: 11 to 14 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 100 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition
Pavant and similar soils: 35 percent
Doyce and similar soils: 35 percent
Minor components: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

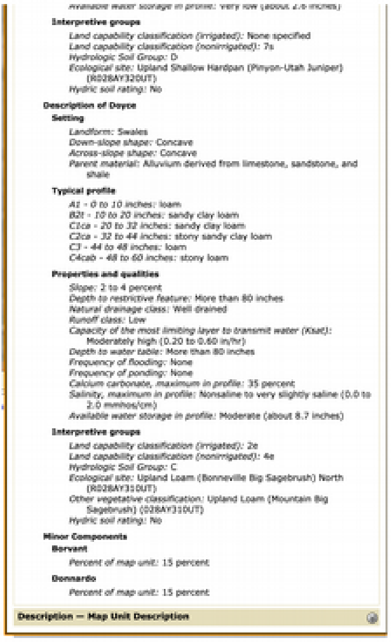
Description of Pavant
Setting
Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and sandstone

Typical profile
Ap - 0 to 7 inches: loam
C1 - 7 to 13 inches: clay loam
C1ca - 13 to 17 inches: clay loam
C2cam - 17 to 29 inches: indurated

Properties and qualities
Slope: 4 to 8 percent
Depth to restrictive feature: 10 to 20 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 45 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Upland Shallow Hardpan (Pinyon-Utah Juniper) (R028AY320UT)
Hydric soil rating: No

Description of Doyce
Setting
Landform: Swales
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium derived from limestone, sandstone, and



Available water storage in profile: Very low (about 2.6 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Upland Shallow Hardpan (Pinyon-Utah Juniper) (R028AY320UT)
Hydric soil rating: No

Description of Doyce
Setting
Landform: Swales
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium derived from limestone, sandstone, and shale

Typical profile
A1 - 0 to 10 inches: loam
B2t - 10 to 20 inches: sandy clay loam
C1ca - 20 to 32 inches: sandy clay loam
C2ca - 32 to 44 inches: stony sandy clay loam
C3 - 44 to 48 inches: loam
C4cab - 48 to 60 inches: stony loam

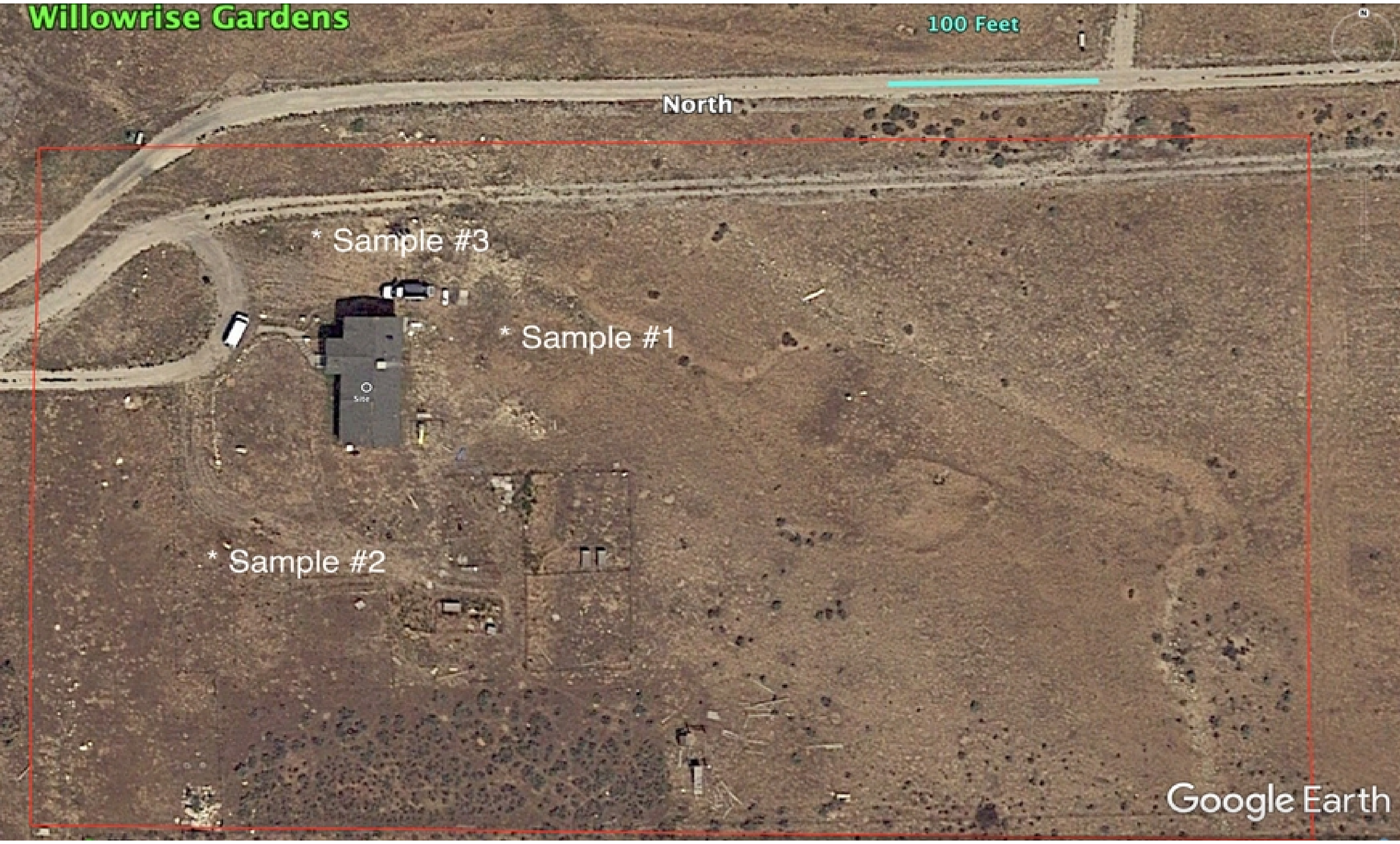
Properties and qualities
Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Upland Loam (Bonneville Big Sagebrush) North (R028AY310UT)
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components
Borvant
Percent of map unit: 15 percent

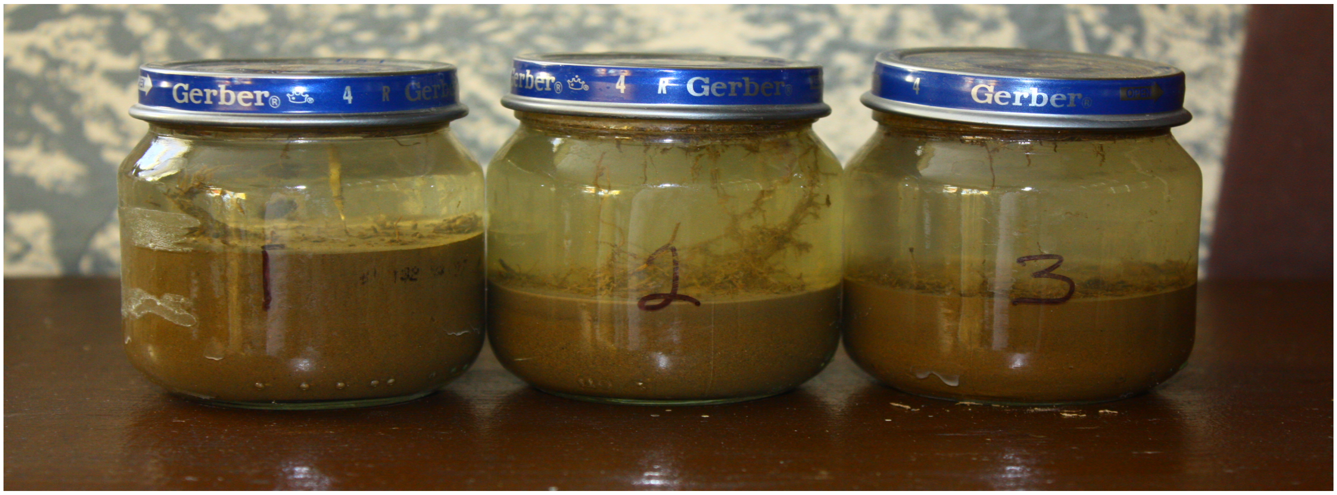
Donnardo
Percent of map unit: 15 percent

Soil Samples

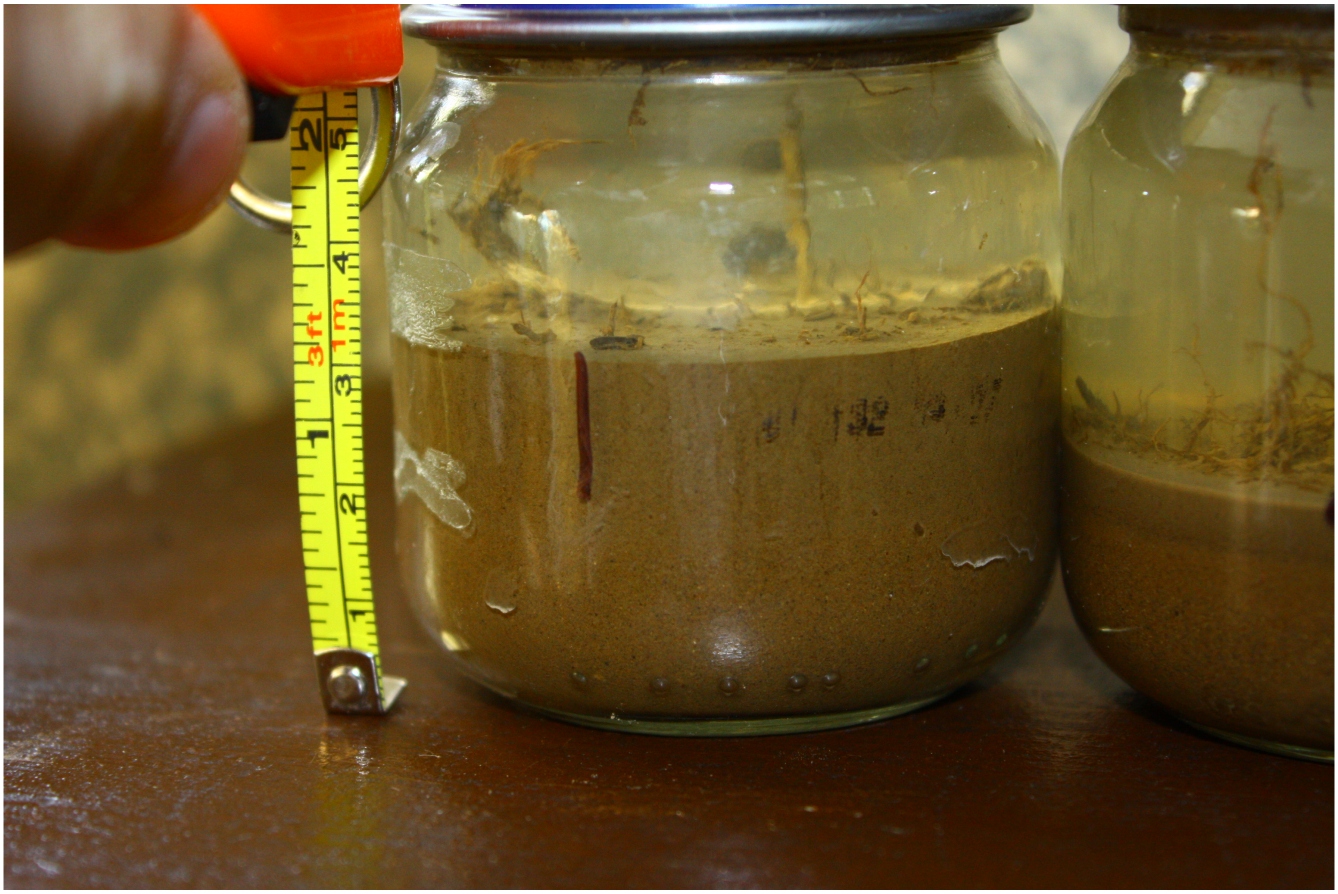


(Samples taken at the asterisks)

Jar Test



Soil 1: From a north-facing side of an on-contour ditch, which was dug two years ago.



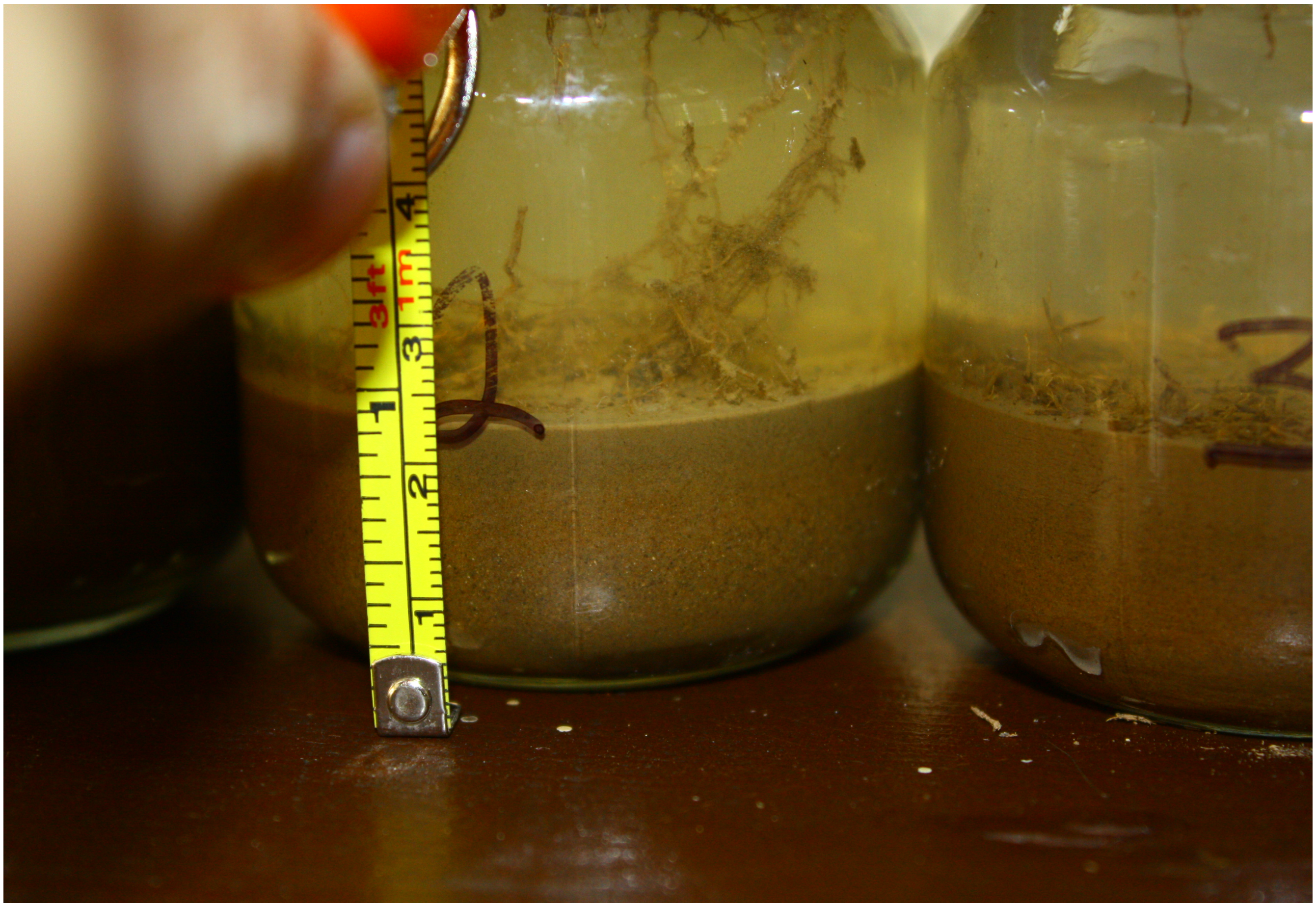
3.25 cm total

Clay: 1.25 cm, 38.5%

Silt: 2cm, 61.5%

Sand: None detected. I was puzzled by this, so I got another sample and ran the test again, with the same result.

Soil 2: From a pen temporarily used as a goat pen.



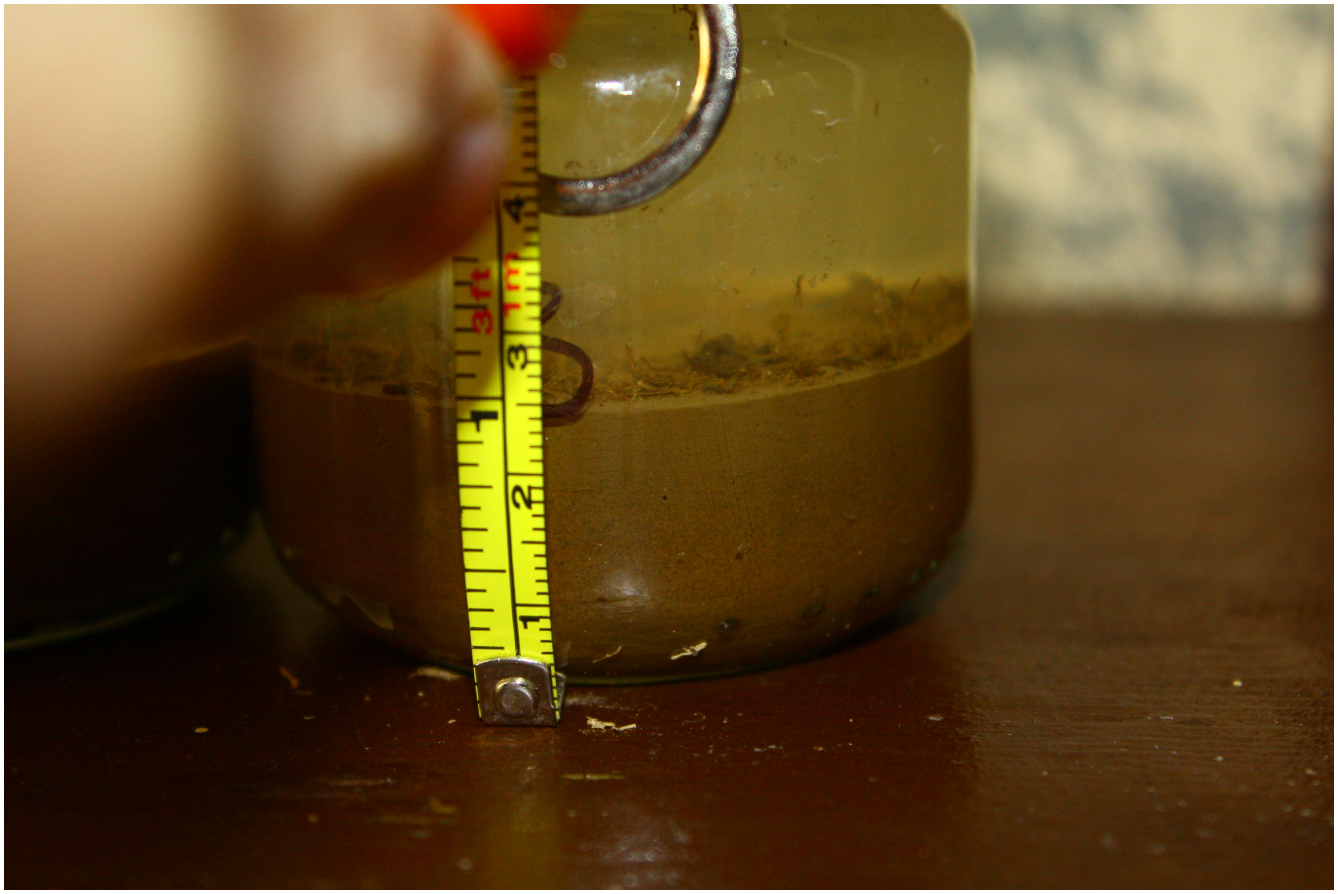
2.25 cm total

Clay .45 cm, 20%

Silt .55 cm, 24.5%

Sand 1.25 cm (very fine sand), 55.5%

Soil 3: From right next to the woodpile, otherwise undisturbed.



2.375 cm total

Clay .775 cm, 33%

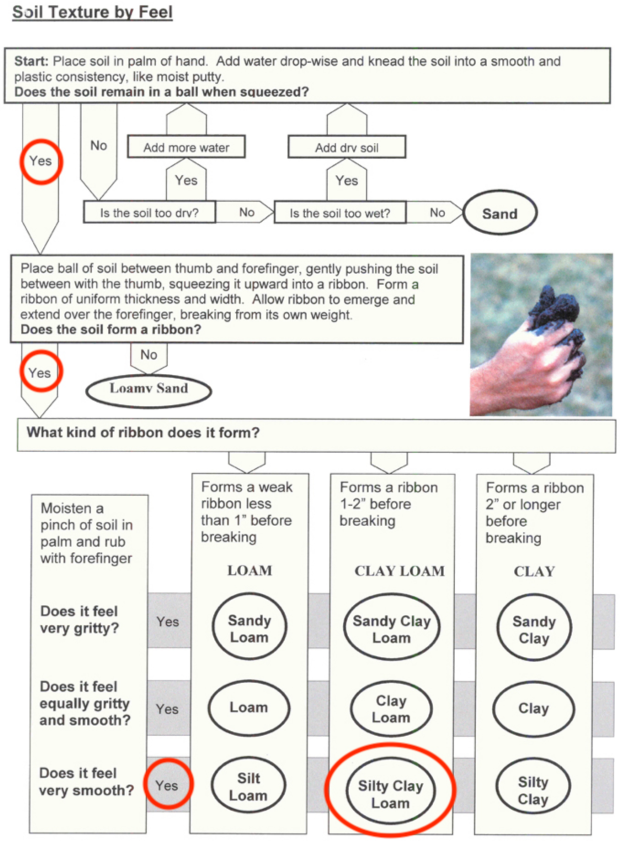
Silt .6 cm, 25%

Sand 1 cm (very fine sand), 42%

Hand-Ribbon Test

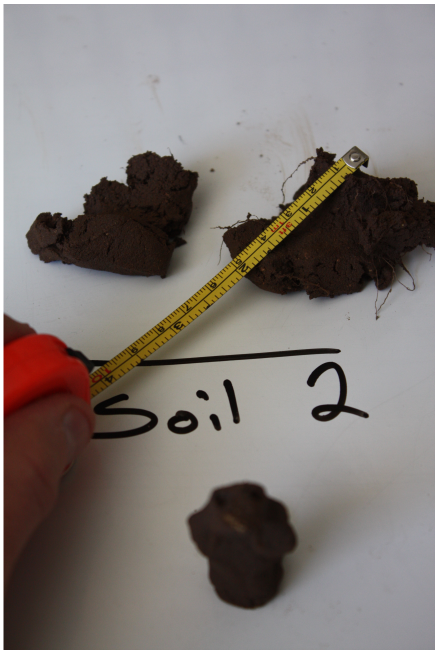
For each of my soil samples, I also molded a little sculpture… for fun.

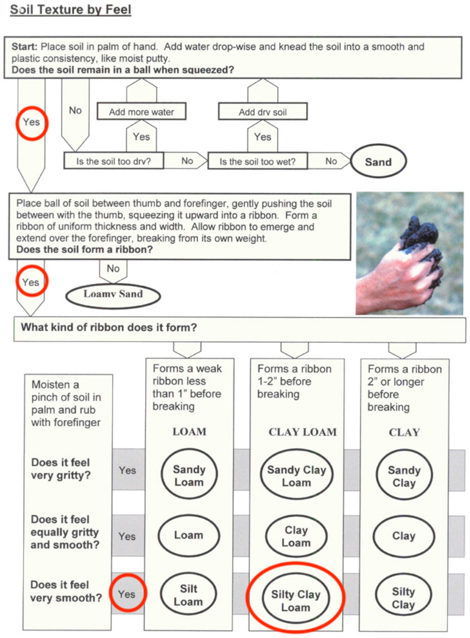
1. From a north-facing side of an on-contour ditch, which was dug two years ago.


Soil Texture by Feel
Start: Place soil in palm of hand. Add water drop-wise and knead the soil into a smooth and plastic consistency, like moist putty.
Does the soil remain in a ball when squeezed?
Yes
No
Add more water
Add dry soil
Yes
Yes
Is the soil too dry?
No
Is the soil too wet?
No
Sand
Place ball of soil between thumb and forefinger, gently pushing the soil between with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow ribbon to emerge and extend over the forefinger, breaking from its own weight.
Does the soil form a ribbon?
Yes
No
Loamy Sand
What kind of ribbon does it form?
Moisten a pinch of soil in palm and rub with forefinger
Forms a weak ribbon less than 1" before breaking
LOAM
Forms a ribbon 1-2" before breaking
CLAY LOAM
Forms a ribbon 2" or longer before breaking
CLAY
Does it feel very gritty?
Yes
Sandy Loam
Sandy Clay Loam
Sandy Clay
Does it feel equally gritty and smooth?
Yes
Loam
Clay Loam
Clay
Does it feel very smooth?
Yes
Silt Loam
Silty Clay Loam
Silty Clay

2.

From a pen temporarily used as a goat pen.




Soil Texture by Feel

Start: Place soil in palm of hand. Add water drop-wise and knead the soil into a smooth and plastic consistency, like moist putty.
Does the soil remain in a ball when squeezed?

[✓ Yes] No

Add more water — Yes — Is the soil too dry? — No — Is the soil too wet? — Yes — Add dry soil — No — Sand

Place ball of soil between thumb and forefinger, gently pushing the soil between with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow ribbon to emerge and extend over the forefinger, breaking from its own weight.
Does the soil form a ribbon?

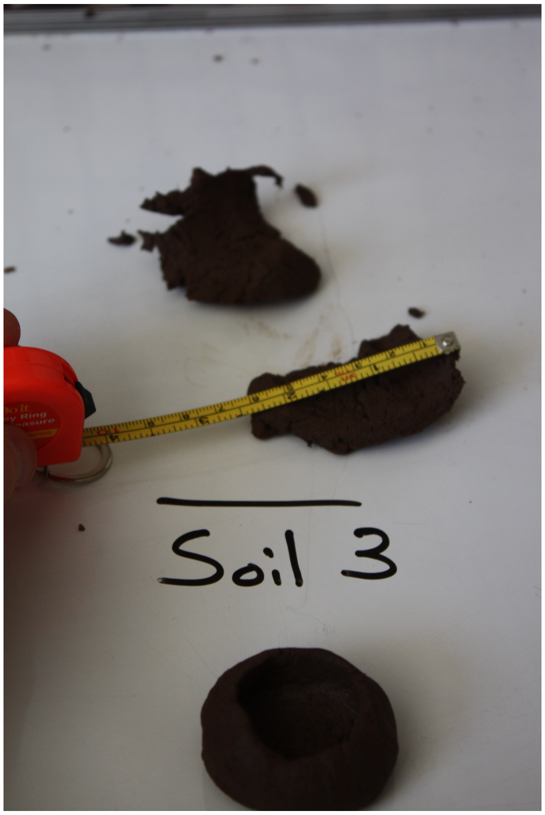
[✓ Yes] No — Loamy Sand

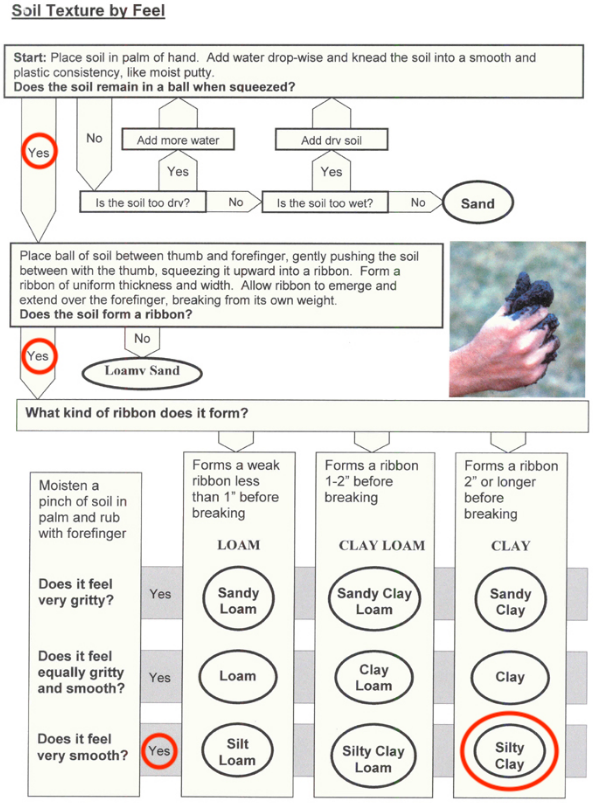
What kind of ribbon does it form?

Moisten a pinch of soil in palm and rub with forefinger		Forms a weak ribbon less than 1" before breaking LOAM	Forms a ribbon 1-2" before breaking CLAY LOAM	Forms a ribbon 2" or longer before breaking CLAY
Does it feel very gritty?	Yes	Sandy Loam	Sandy Clay Loam	Sandy Clay
Does it feel equally gritty and smooth?	Yes	Loam	Clay Loam	Clay
Does it feel very smooth?	[✓ Yes]	Silt Loam	[✓ Silty Clay Loam]	Silty Clay

3.

From right next to the woodpile, otherwise undisturbed.




Soil Texture by Feel

Start: Place soil in palm of hand. Add water drop-wise and knead the soil into a smooth and plastic consistency, like moist putty.
Does the soil remain in a ball when squeezed?

[✓ Yes] No

Add more water — Yes — Is the soil too dry? — No — Is the soil too wet? — Yes — Add dry soil — No — Sand

Place ball of soil between thumb and forefinger, gently pushing the soil between with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow ribbon to emerge and extend over the forefinger, breaking from its own weight.
Does the soil form a ribbon?

[✓ Yes] No — Loamy Sand

What kind of ribbon does it form?

Moisten a pinch of soil in palm and rub with forefinger		Forms a weak ribbon less than 1" before breaking LOAM	Forms a ribbon 1-2" before breaking CLAY LOAM	Forms a ribbon 2" or longer before breaking CLAY
Does it feel very gritty?	Yes	Sandy Loam	Sandy Clay Loam	Sandy Clay
Does it feel equally gritty and smooth?	Yes	Loam	Clay Loam	Clay
Does it feel very smooth?	[✓ Yes]	Silt Loam	Silty Clay Loam	[✓ Silty Clay]

Percolation Test

With the perc test, I filled the holes, waited, and got the measurements after an hour, and it wasn't until the next day (Monday) that I realized I was supposed to take a *photo* with the ruler at the hour. Oops. But I took a photo of each anyway.

1. Started at 12:32 : measured at 1:32 – 4.25 inches in one hour

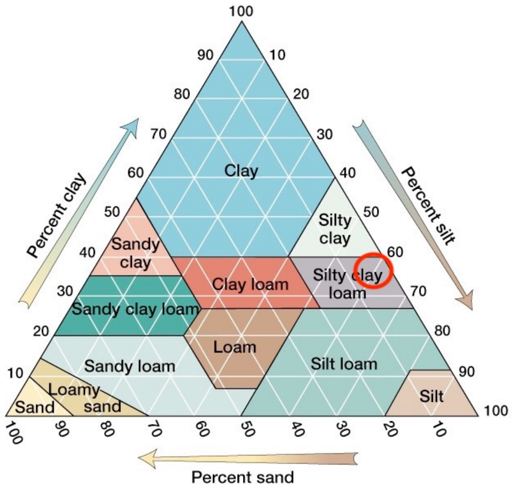
2. Started at 12:38 : measured at 1:38 – 5.5 inches in one hour

3. Started at 12:46 : measured at 12:46 – 4.5 inches in one hour

Soil Profile

Photo of each sample area is included in the percolation test. But here are the soil texture pyramids for each.

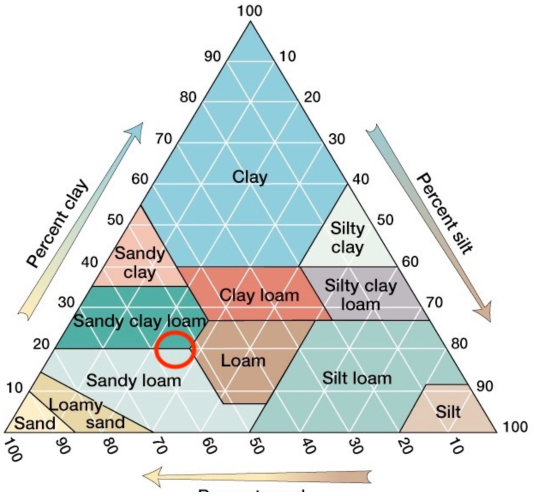
1. From a north-facing side of an on-contour ditch, which was dug two years ago.



This soil is next to a swale I dug two years ago, but have otherwise neglected. The only organic material on the spot is what little grass and dry wild plants grow without maintenance. The area is infrequently played on by kids.

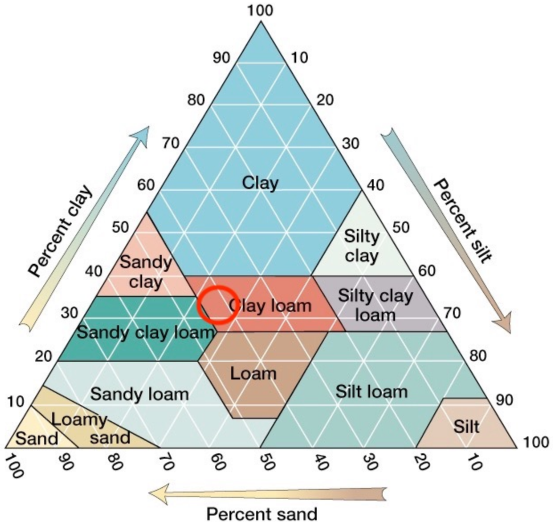
According to the results of my jar test, this is silty clay loam.

2. From a pen temporarily used as a goat pen.



We had goats for 4-5 months, but sold them about a month or two ago. This soil is from the pen they lived in. The area was otherwise ignored, so wild grass and weeds tend to grow in the area.

According to the results of my jar test, this is sandy clay loam/sandy loam.



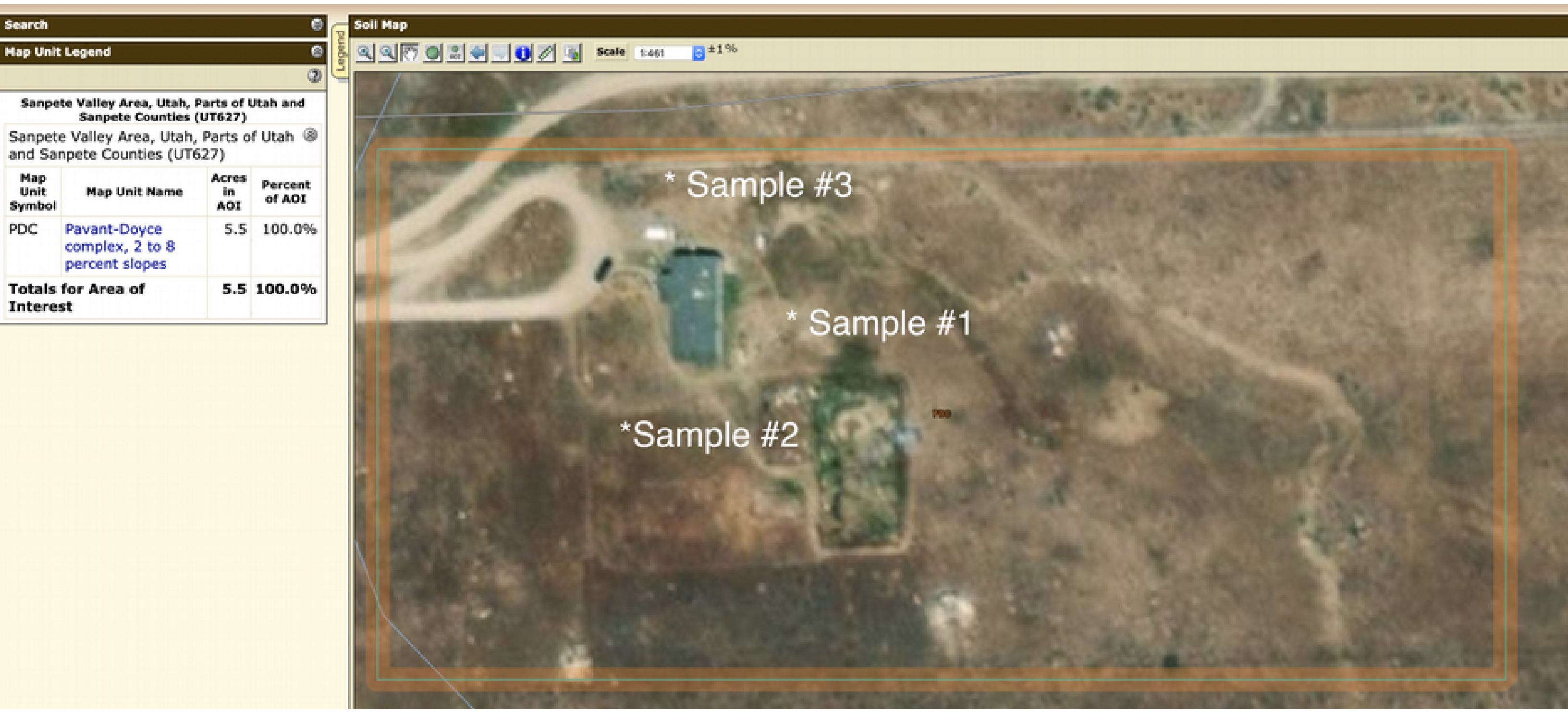
3. From right next to the woodpile, otherwise undisturbed.

   Our woodpile collection, mostly from neighbors and strangers dropping off pruned branches and trees lays out in an otherwise ignored area of the property. This hole is not *in* the woodpile, but right next to it. Wild grass and dry, neglected meadow area.

   According to the results of my jar test, this is clay loam.

Narrative Summary

Soil Map:



Sanpete Valley Area, Utah, Parts of Utah and Sanpete Counties (UT627)

Sanpete Valley Area, Utah, Parts of Utah and Sanpete Counties (UT627)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PDC	Pavant-Doyce complex, 2 to 8 percent slopes	5.5	100.0%
Totals for Area of Interest		**5.5**	**100.0%**

(asterisks indicate specific location of sample)

1. The Web Soil Survey map lists the soil of the site as *loam*, or *clay loam*. This doesn't directly correlate with the results of my first two jar tests, which listed my soils as silty clay loam and sandy clay loam, but it did result in the same type in the third jar test, clay loam. Since sample #3 is likely the most undisturbed area of the samples, I suppose it makes sense that the different result may be because the other two areas have had some disturbance in the last few years. One from the digging of the swale, and the other from goats.

The ribbon test had different results. The first two tested as silty clay loam, which matches the result of my first jar test, but the last listed as silty clay. So either I'm not getting an accurate result with my sandy clay loam (very possible, since the sand in the jar sample is a really, really fine sand), or the ribbon test is only mostly accurate. The ribbons came out just barely longer than 2 inches. Otherwise they would have resulted in silty clay loam, like the other two.

Overall, I think it may be fair to suspect that most of the soil on the site (untreated soil, anyway) is clay loam and silty clay loam.

2. My clay loam and silty clay loam should be good at holding nutrients, and may do better than sandy soils at retaining water. I will have to be careful about drainage, as the soil may struggle to sufficiently drain water when it comes in abundance. I've noticed this trend after the snow melts. Water runs down dirt roads and bare land like a stream, and if the soil becomes compacted, it's very difficult for plants to penetrate the soil. This might be helped with good pioneer species where soil is compacted.

3. We have good access to branches, leaves, and wood particles. Planned right, we should be able to add considerable humus by covering the soil with sticks, wood-chips, leaves, and dried grass/hay. These would also help retain some of the moisture at the soil level after a rain/snowstorm where the ground tends to get especially dry.

Breakdown of the major soil-types on the property:

Clay Loam: A very clay-centered soil, which makes it good for holding nutrients and water for plants, but it may struggle at getting good drainage for those plants. It can be good for pond construction. When it gets wet, it tends to expand, but then shrink as it dries.[43] This helps aerate the soil/roots, but makes it incredibly mucky to walk through when wet.

My observation is that in the spring, when snow has melted, and the immediate surface has dried, this soil sits waiting to crumble and sponge in when stepped on. If compaction (such as stepping) can be avoided, this texture gives the soil a good opportunity to grow plants well. But if compacted, it can quickly become hard-packed and dusty.

Silty Clay Loam[44]: Like clay loam, it's fairly good at retaining water and nutrients, and though it struggles some with drainage, it does better than clay loam, and is therefore better for growing plants. Silty clay loam is also improved using compost, mulch, and other forms of added humus.

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[43] http://www.southernmulch.com/article-what-is-clay-loam.php

[44] https://www.sciencedirect.com/topics/earth-and-planetary-sciences/silty-clay

Local Ecological Survey

Chas Hathaway

Questions:

Describe a local biological food chain.

An example of a local biological food chain: the seed of mountain brome, *Bromus marginatus,* is eaten by harvester ants *Pogonomyrmex barbatus*, which is eaten by the desert horned-lizard, *Phrynosoma platyrhinos,* which is eaten by the Swainson hawk, *Buteo swainson,* which can be (but is not often) eaten by the bald eage, *Haliaeetus leucocephalus.* Eagles are at the top of the food chain, but the nestlings may be preyed on by the skunk, *Mephitis mephitis*, and skunks are sometimes killed (though not eaten) by feral dogs.

Another would be: The roots (tubers) of the prickly pear, *Opuntia chlorotica,* are eaten by pocket gophers, *Thomomys bottae*, which are eaten by the gopher snake, *Pituophis catenifer,* which is eaten by the coyote, *Canis latrans*, which is eaten by the cougar, *Puma concolor.* No one eats the cougar (other than the young), but they do compete with bears and wolves for food.

Name five birds that inhabit your region.

1. Swainson Hawk, *Buteo swainsoni*, Often seen flying over our house and site year-round.

2. Bald Eagle, *Haliaeetus leucocephalus.* More often seen in winter, but some throughout the year. (And the only bird from this list that I haven't caught a photo of yet!)

3. Killdeer, *Charadrius vociferus.* We had a little family of them move in on the site last year. The kids loved watching the babies grow up.

4. Ringneck Dove, *Streptopelia capicola.* We see these with probably a dozen varieties of pigeons. We have a feral pigeon population next door, and they often come for a snack at chicken feeding time. I'm thinking of setting up some houses for them on top of the pavilion to see if they'll take up residence here.

5. Western Kingbird, *Tyrannus verticalis*. We seem to have several varieties of yellow songbirds around here, meadowlarks, etc. This is one that shows up regularly.

What is the climax community of flora and fauna in your area?

25% slender wheatgrass, *Elymus trachycaulus*

15% mountain brome, *Bromus marginatus*

5% wheatgrass (*Triticum* species)

5% other grasses

1% biscuitroot (*lomatium* species)

2% peavine (Sweetpea, or *Lathyrus* species)

1% tall larkspur, *Delphinium barbeyi*

15% other forbs

4% big sagebrush, *Artemisia tridentata*

10% oakbrush (scrub oak), *Quercus gambelii*

7% snowberry, *Symphoricarpos oreophilus*

10% other shrubs

What species and food webs are present in your climax ecosystem?

This is a graphic I put together demonstrating a local food web. Arrows point to what eats that species.

Name five pioneer plants in your ecosystem.

These pioneer plants were chosen not because they are native, but rather because they are available to me in much greater abundance than other trees, and fulfill several ecological and practical functions.

1. Willow trees, such as globe willow (*Salix globosa)* and weeping willow (*Salix babylonica*)

2. Fruit trees, via food stamps

3. Rhubarb (*Rheum rhabarbarum*), also via food stamps

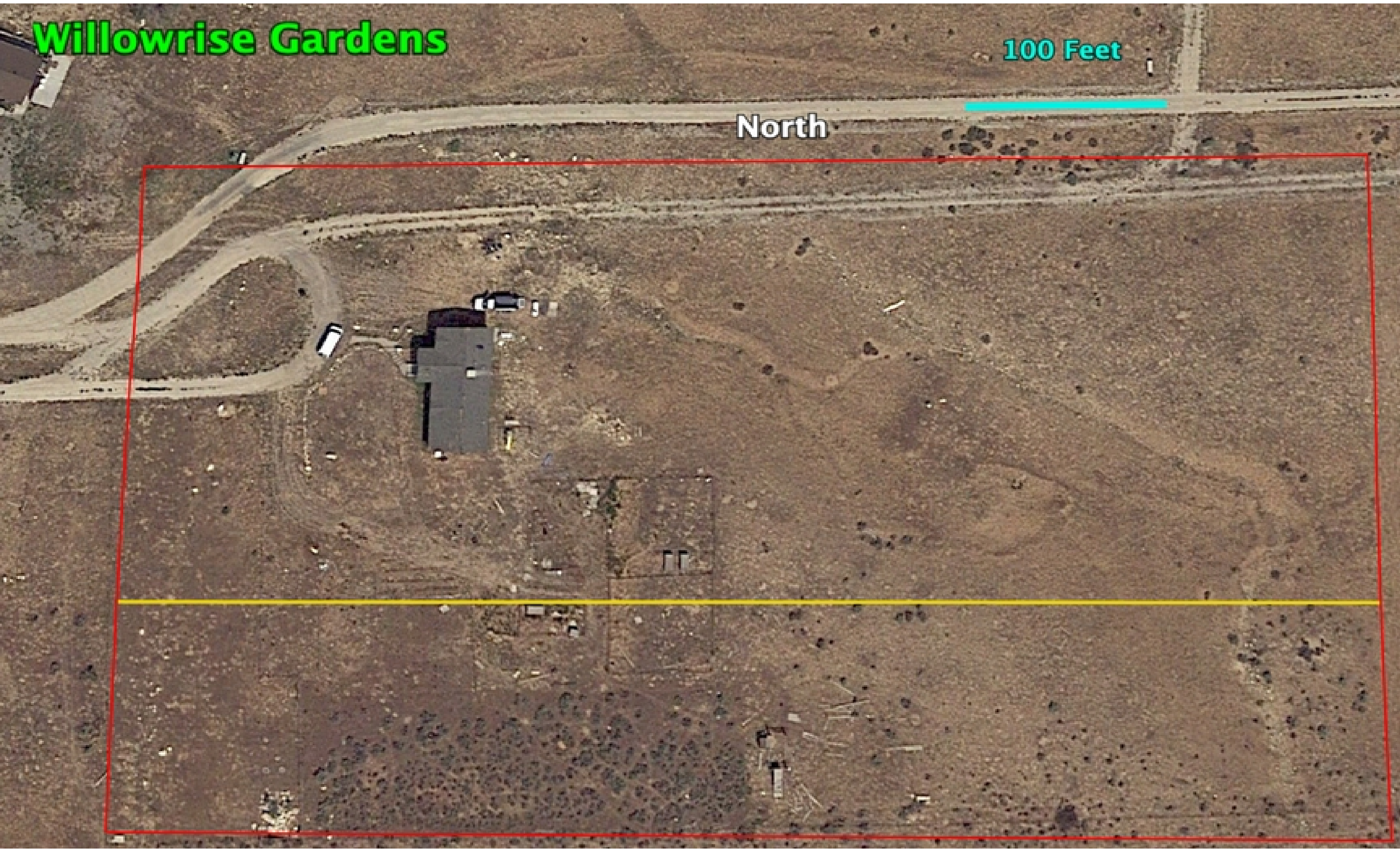
4. Everlasting sweet-pea (*Lathyrus latifolius*)

5. Various forms of mint, such as peppermint (*Mentha piperita*), lemon balm (*Melissa officinalis*), and spearmint (*Mentha spicata*)

Elevation View

For this assignment you will make an elevation map of your site. This is a side view of your site showing elevation changes in topography, height of roof peaks and gutters, height of trees, and heights of ditches, creeks, and drains. Depending on your design site, this may be simple or difficult. Portraying an accurate elevation drawing of the site to scale will help to make clear the potentials for moving water and using changes in elevation to your advantage in your design.

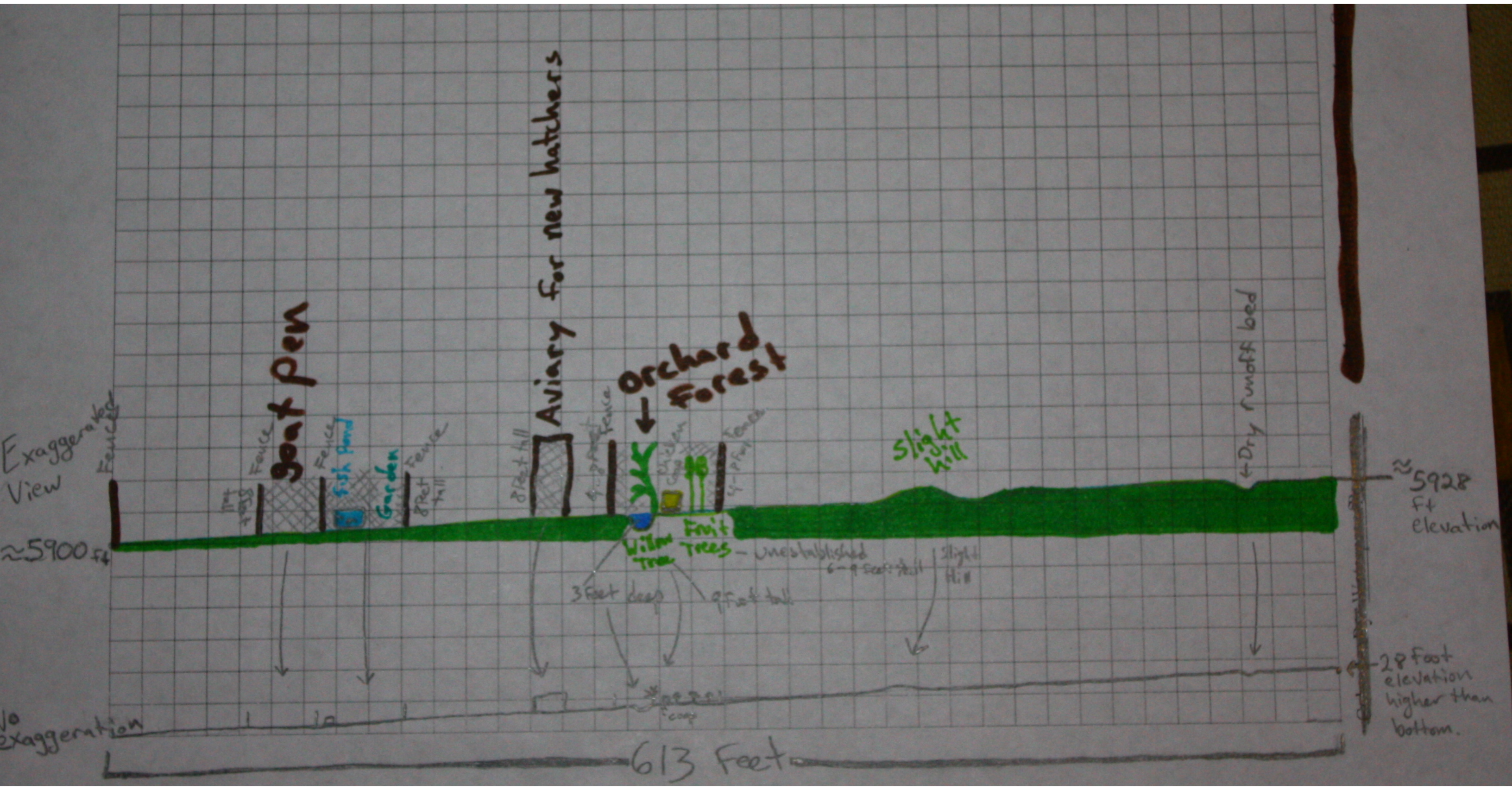
A. I'm not entirely sure this is the line that has the greatest changes in elevation, but I do think it's a rather characteristic representation of the elevation changes across the property.



B. The yellow line is 613 feet going exactly west to east.

C. As is demonstrated in the graphic, the slope is very slight, preventing water from rushing over the system, which may provide better opportunity for water catchment, storage, and passive harvesting.

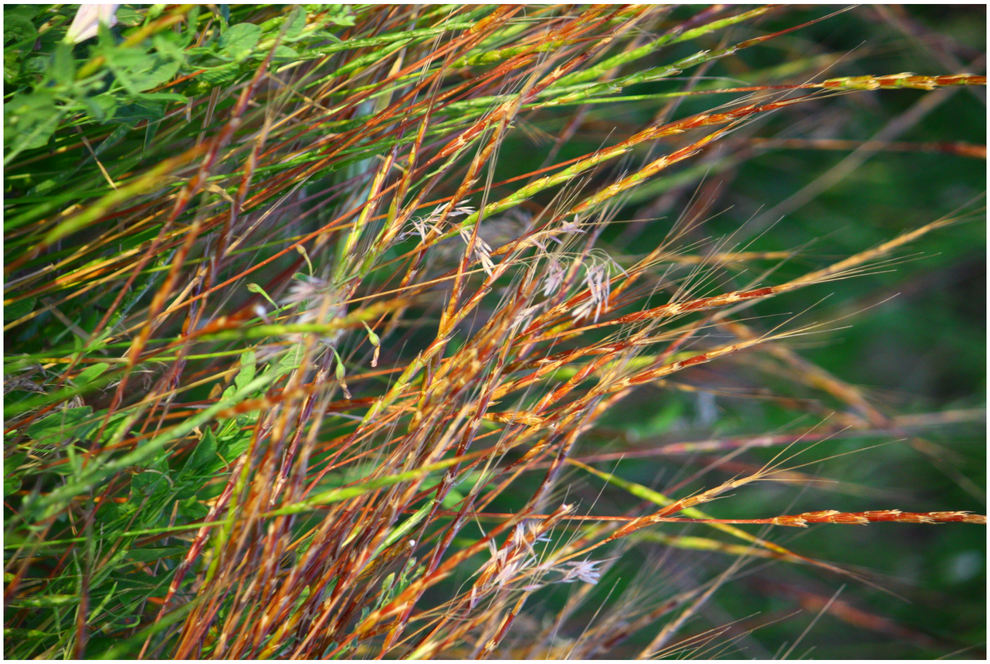
Section View



D. I drew the scale, non-exaggerated version in pencil, but since there is nothing on the elevation line over 8 feet tall, they come out ridiculously small. For the purpose of the assignment, I indeed left the exaggeration out, but I did add a second graphic above the first that *is* exaggerated in order to better visualize the elements represented.

What are five native or naturalized medicinal plants in your area and what are they used for? What part of the plant is used?

Jointed Goatgrass, *Aegilops cylindrica*



Jointed goatgrass in a reseeding annual, native to Russia and Europe, introduced into the United States in the late 1800s.

Uses:

Primary use: Edible wheat-like grains.

Edibility: Though I can find no certain confirmation by foraging experts (either confirming or denying the edibility of jointed goatgrass grain), as a close relative to wheat (which can even cross with wheat, especially winter wheat), it is my opinion that the grain can be eaten like wheat. I have eaten it in two forms of bread so far—as a scone, and in banana bread, where in both cases, jointed goatgrass grain flour (ground with the chaff and all) was the only flour used. The taste was pleasant, rather comparable to wheat, though certainly more fibrous than ordinary flour. This may be because I didn't fully shuck the grain of its fibrous outer layer, however. My guess is that shucking it would make it less fibrous.

Isolating the grain from the thick chaff can be tricky, but gratefully the chaff can be ground with the grain, adding fiber to the flour. As for how nutritious it is, I have no idea—I can only assume it's similar to wheat.

Medicinal: None known.

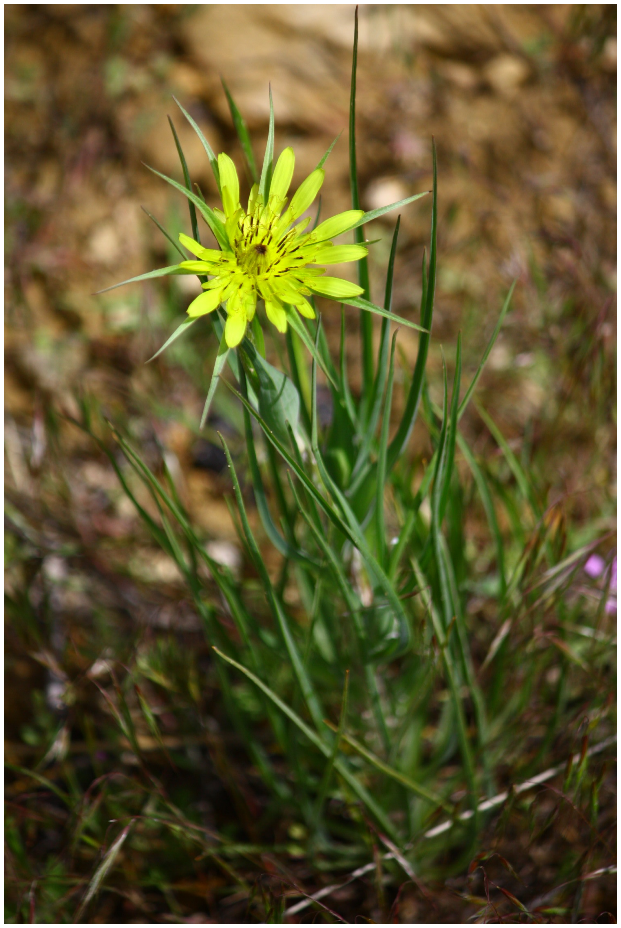
Ecological: When ordinary wheat mixes with jointed goatgrass, the hybrid wheat can be more drought and cold tolerant than ordinary wheat. I'd like to find a way to accomplish this.

Cautions: Like I said, I haven't confirmed via Internet or books whether jointed goatgrass actually is edible. Likewise, I can find nothing suggesting any level of toxicity. Try it at your own risk. Just know that most wild grass grains are edible and nutritious—though there are a few exceptions. There is a ton of information out there about jointed goatgrass being an invasive species, and "contaminating" wheat fields, since farmers can't use herbicides on it lest it also kill their closely related wheat.

Oh, and be careful if you try to grind jointed goatgrass in an electric grain grinder if you're not planning on shucking it first, since the chaff plugs up the entryway for the grain, so that the grinder runs dry without grinding anything. To remedy this, blend grains in a blender or food processor first, or perhaps instead. A Magic Bullet blender would probably do it nicely.

Salsify, *Tragopogon dubius*

Also known as yellow salsify, western salsify, goat's beard, wild oysterplant, and common salsify. Salsify is an annual (though sometimes biennial), and is native to Eurasia, but introduced into the United States in the early 1900s as a garden plant.[45]



Uses:

Primary use: Edible leaves and lower stem.

Edibility: The whole plant is edible. Salsify leaves, stem and root can be eaten raw or cooked,[46] and have a mild flavor. Some say the root/lower stem tastes like oyster, earning it the nickname, "oyster plant." As with most wild edibles, the younger it is, the better it tastes.

Medicinal: None known.

Ecological: Salsify can live in almost any plant community type (beach, forest, prairie, grasslands, etc), and while it can spread quickly, distribution is usually spread rather thin, so that it doesn't invade other species.

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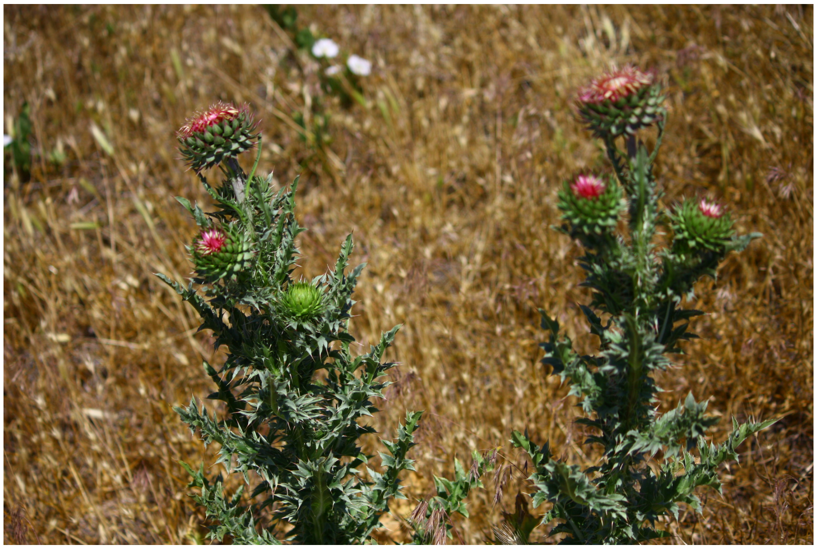
[45] http://www.fs.fed.us/database/feis/plants/forb/tradub/all.html

Salsify is also a good sacrificial plant. When black aphids (*Brachycaudus tragopogonis*) are present on a property, they will ignore other plants to live on and eat salsify. In this case, salsify plants should usually be left alone, as generations of aphids will live and die on one salsify, leaving other plants unharmed. Some suggest, however, that these particular aphids *only* eat salsify. I don't know if that's true or not, but if so, they're still a benefit, because the concentrated presence of black aphids invites ladybugs, which are incredibly beneficial to gardens.

Scotch Thistle, *Onopordum acanthium*



AKA cotton thistle. Scotch thistle is an annual or biennial (depending on how late in the season they germinate), native to Eurasia.

Uses:

Primary use: Edible raw fruit and peeled stem.

Edibility: The whole plant is edible raw, steamed, or cooked, but its also terribly spiny. Make sure you remove the spines before preparing it to eat. The trick with thistle is to know how to harvest it and remove the spines without getting pricked. Flower buds can be cooked as a substitute for artichoke (which is very closely related).

Peeled stems can be cooked or eaten like celery. They can be harvested by cutting off the stock (wear gloves, because the thistle will jab you), running a knife down the length of the stem, and peeling the center out. That stalk can be eaten raw or cooked. Similarly, you can peel the greens off the leaves, leaving only the center midrib of the leaf. Again, eat it raw or cooked. Spines can be removed from leaves by cutting all the leaf edges off with a knife or scissors.

Some people take the whole plant and roast it over the fire, and then eat the cooked core. Green Deane of EatTheWeeds.com recommends cooking the young (about a foot tall) stalk and adding butter and salt.[47]

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[46] http://www.pfaf.org/user/Plant.aspx?LatinName=Tragopogon+dubius

[47] http://www.eattheweeds.com/thistle-touch-me-not-but-add-butter-2/

The inner core of the flower stalk is supposed to be quite tasty, and fairly easy to harvest. The bottom of the flower bud can also be harvested without two much trouble.
Seeds can be harvested for oil (they are about 20% oil) that can be used like olive or vegetable oil in cooking.

Medicinal: Scotch thistle is known to have a very positive effect on the heart, and can be consumed as a heart tonic. The juice can be used to treat ulcers[48] and cancers.[49] As an astringent, drinking liquid soaked in Scotch thistle root can reduce mucous production in the mouth and throat. The leaves and root were historically used to treat rickets in children, as well as for treating a crick in the neck,[50] though I don't know the specific method of application for the crick. One might try a lotion or salve applied topically, though drinking a tea or juice from the plant wouldn't hurt.
The flowers can be boiled to concentrate the juices, and the juice can be used for treating eye diseases, as well as being made into lotions for treating wounds.

Ecological: In sufficient quantity, Scotch thistle can be used as a fence or barrier for deer and other garden-eaters, though this is best done upwind of the protected area, since the seeds will continue to spread.

Practical/Artistic: The stalk can be used to make cordage (rope). The down (fluff) can be used for feather guides for arrows. The Seminole Indians used the stems to make blow darts. The pedals can be used for dye or food coloring. Stem hairs have been used in making pillows. The oil from the seed can be used as fuel for lamps.

Cautions: Watch out for the spines, they can be brutal. Some people suffer from sensitivity toward thistle that makes contact even more painful, though sensitivity to the plant itself seems to be rare. Also, though edible like the rest of the plant, some people have reported that eating the roots gives them gas, so if that concerns you, you'd probably best cook the root.[51]

Povertyweed, Iva axillaris
AKA deer root, sumpweed, and deathweed. But don't let this last name scare you—povertyweed is a nicely scented, mildly medicinal plant. Povertyweed is perennial, native to North America.

Uses:

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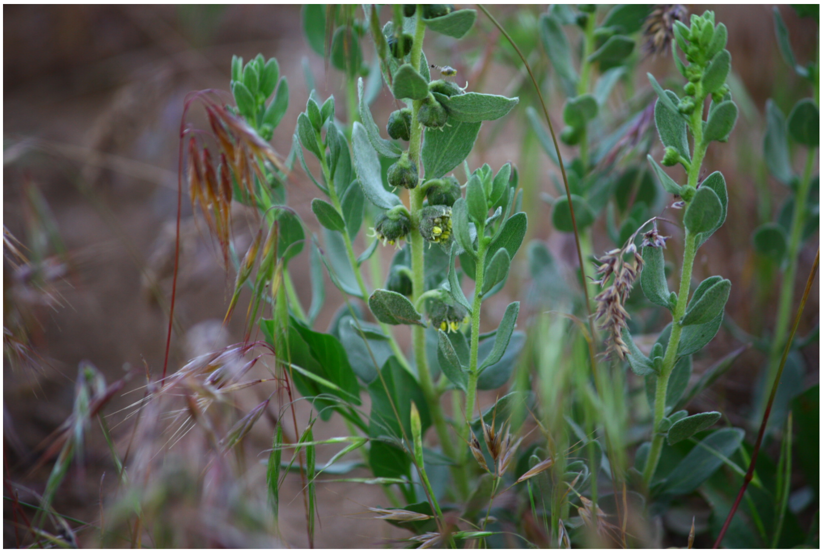
[48] http://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1093&context=jmap

[49] http://www.naturalmedicinalherbs.net/herbs/o/onopordum-acanthium=scotch-thistle.php

[50] http://botanical.com/botanical/mgmh/t/thistl11.html

[51] http://practicalplants.org/wiki/Onopordum_acanthium

Primary use: treating mouth sores and throat ulcers.



Edibility: Other than the mild medicinal uses, I can find no edible uses for povertyweed.

Medicinal: Povertyweed can be used to treat mouth and throat ulcers by chewing the fresh leaves and then swallowing the juice (the leftover pulp can be spat out). A leaf tea was often used by the Shoshone to treat stomachaches, cramps, and diarrhea. A wash of the tea can also be applied directly to treat rashes and itches.[52] As a serious sufferer of canker sores, I'm eager to try this stuff on them.

Ecological: Povertyweed thrives where many other plants won't, even in salty and alkaline soils, making it useful for dry climates where little else survives. However, it does seem to contain properties to discourage other plants from growing around it. It can be used as a source of food for honey bees, and can also be used to add particular flavor to honey.[53] It mainly propagates by creeping rhizomes, so it is good for increasing soil biology and aeration.[54]

Cautions: Some of the Shoshone used povertyweed as a form of birth control and can even promote the abortion of a child, so pregnant women shouldn't take this plant internally. Those allergic to pollen should know it is an allergen.

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[52] https://books.google.com/books?id=tg_bPUzhJ90C&pg=PT114&lpg=PT114&dq=Iva+axillaris+uses&source=bl&ots=t6bjB3yHIN&sig=OnTMv3r708T89YsTx9VJnHTVV9Y&hl=en&sa=X&ved=0ahUKEwiS5cLisbnNAhUJ8mMKHZErCcwQ6AEIRjAL#v=onepage&q=Iva%20axillaris%20uses&f=false

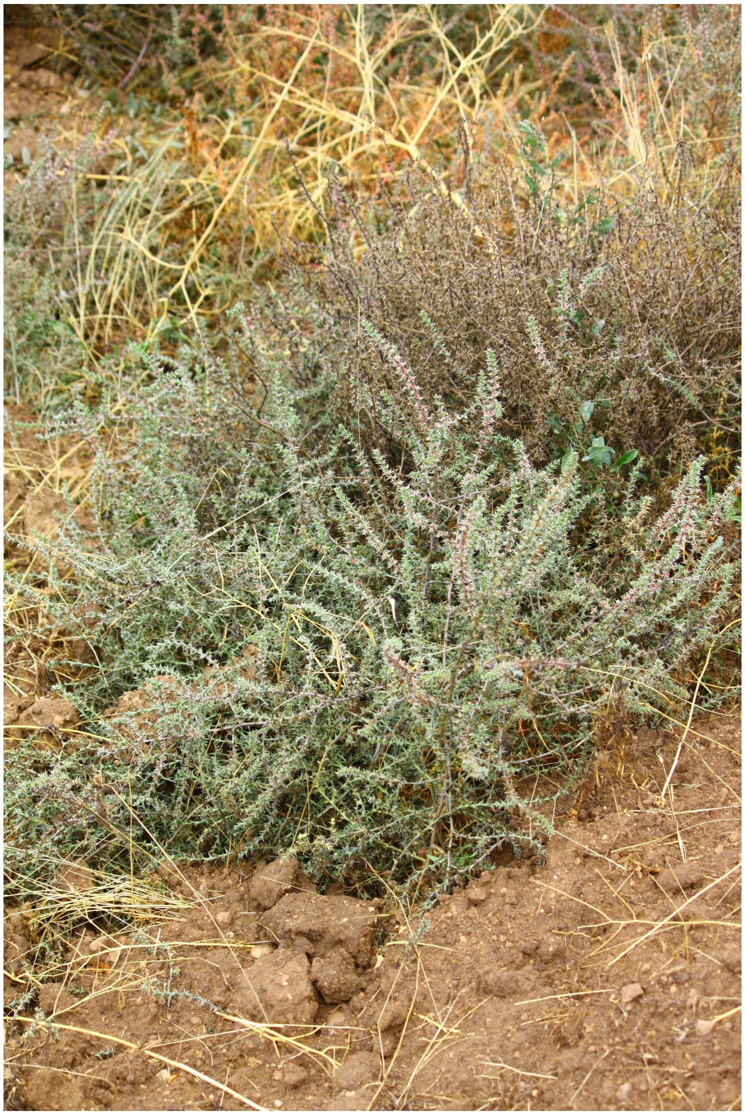
[53] http://www.pollenlibrary.com/Specie/Iva+axillaris/

[54] http://biology.burke.washington.edu/herbarium/imagecollection.php?Genus=Iva&Species=axillaris

Russian Thistle, *Kali tragus*

AKA Prickly saltwart, windwitch, or common saltwart. Russian thistle has had many Latin names,[55] such as *Salsola kali*[56] and *Kali turgidum*. Only recently has it adopted the scientific name *Kali tragus*. Russian thistle is an annual tumbleweed, native to Eurasia, but accidentally imported from Russia into North America in the 1870s with the intended flaxseed.

Uses:



Primary use: eating young leaves and shoots raw.

Edibility: Young tender leaves and shoots are edible raw or cooked, and have a mild yet pleasant salty flavor. With age, they become hard and spiny, and should no longer be eaten, since they can scratch or irritate the throat. The seed can also be roasted and eaten.

Medicinal: Russian thistle can be chewed into pulp and then placed on wasp and bee stings, as well as ant bites, to sooth them. We've used this on our wasp/bee stings, and found it does offer fairly quick relief. Also, the plant can be soaked in water or alcohol to make an external wash for smallpox and flu.[57]

Ecological: The thick thorny bush of Russian thistle can be a great deterrent/solution to erosion. It adds a good deal of biomass to the ground, and because of the thorns, protects the ground against heavy human or animal foot traffic. I've found it to be a good thing to grow around young trees, since it creates a massive thorn barrier that deters rabbits and young deer from eating the bark of the trunk.

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[55] Russian Thistle, Prickly Saltwart, *Salsola kali* or *Kali turgidum*. It appears this species has hopped around in classification, which is why it has more than one Latin name. Some sources (such as the USDA website, and most of the older classification methods) place it in the Chenopodiaceae (Goosefoot and lambsquarters) family. Now that entire family is classified genetically as being in the Amaranthaceae family.

[56] Hossein Akhani, Gerald Edwards, Eric H. Roalson:Diversification *Of The Old World Salsoleae s.l. (Chenopodiaceae): Molecular Phylogenetic Analysis Of Nuclear And Chloroplast Data Sets And A Revised Classification*, (In: International Journal of Plant Sciences 168(6), 2007), 931–956

Practical/Artistic: Russian thistle is sometimes burned and the ashes become sodium carbonate, which can be used for cleaning (in soaps, etc) and in glassmaking. The ashes are usually called soda ash.

Russian thistle is a tumbleweed, but much spinier and sharp than most. Because of this, it can be bunched togethhttp://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/invasive_poverty_weeder and used to reenforce a weak or spindly fence or barrier to discourage unwanted mammals or people from entering an area you would like to protect, such as a garden.
Cautions: First off, be careful about the spines. They can be brutal! Russian thistle does contain (just like it's cousin, spinach) small amounts of oxalic acid, which can be mildly toxic to sensitive individuals. Because of this, it should probably not be consumed in great quantities unless it is cooked, since cooking breaks down oxalic acid. Some people are allergic to Russian thistle, so if you are eating it, start with a very small amount, and then try a little more a day or two later. If you have a negative reaction, stop taking it.

2. *Have you used any of these or other native plants for medicinal use?*

As mentioned in "uses," I've used Russian thistle for wasp stings. I've also used Curlycup Gumweed, *Grindelia squarrosa*, for itches—such as those from mosquito bites and rashes (very effective, by the way), and big sagebrush, *Artemisia tridentata*, for gas pains (not as effective as I'd hoped).

3. *Name one food that people historically ate during each season.*

Dandelion, *taraxacum officinale*, was planted and used by my pioneer ancestors who settled this area in the 1800s. The root was eaten in winter, or boiled to use like coffee. In early spring, the leaves and flowers were used as a hunger-gap food—meaning they would plant dandelion to provide early greens after winter stores ran out but before other crops were mature enough to eat.
Tumble Mustard, *Sisymbrium altissimum,* matures in early summer, and native Americans harvested the seeds for food as a grain. In the fall, they would harvest the seed of lambsquarters, *Chenopodium Album,* and eat them similar to how we use quinoa today (which is a very closely related cousin to lambsquarters, by the way—if you saw a quinoa plant next to a lambsquarters, you might have a hard time telling them apart).

4. *List the plant nurseries in your area.*

There have been many nurseries that have come and gone, but the most consistent is the Walmart Garden Center (20 miles away). Birchcreek Gardens is closer, in Mt. Pleasant, just 4 miles from the site, but I think they might have moved or gone out of business, because they never opened last year. If you're willing to

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[57] http://www.pfaf.org/user/Plant.aspx?LatinName=Salsola+tragus

travel 45 minutes, there's a King's Nursery in Nephi, or in Mayfield (40 minute drive), there is a Skyview Landscape Nursery.

I've had some luck with the Herb Shop in Mt. Pleasant (4 miles away), where they sell sucker trees, bushes, herbs, and such from a little greenhouse they have in the back. It's a good source for plants locally grown, such as elderberries, raspberries, and mints. It's just not as consistent as other nurseries, since they don't place orders or have outside suppliers.

5. List 4 farms in your area that you would be comfortable purchasing your food from and why you would be comfortable purchasing from them?

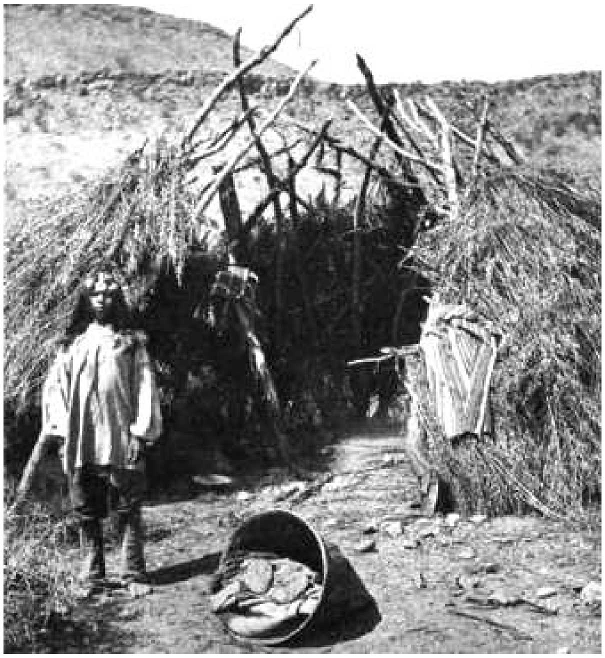
1. Crockett Farm: We know the family well. They raise sheep and have a sheep dairy, producing milk, yogurt, cheese, soap, and other sheep products. They also generally hold to organic practices and their sheep are kept happy and well cared-for. (3 miles away.)
2. Moss Farm: They sell dairy and eggs. And I'll be honest, these first two were the only two I was aware of for sure before this assignment, so numbers 3-4 are farms I haven't tried yet. (2 miles away.)
3. Sunderland Dairy in Chester, Utah (about 3 miles away). Dairy farm. Our county has a major dairy focus–probably because of the prairie rangelands around.
4. Phelps Fruit & Berry, in Payson, UT (60 miles away). This one I'd really like to try. Certainly further away, but worth trying. It's a "U-pick" farm. They have various berries, cherries, and other fruits.

Buildings Survey

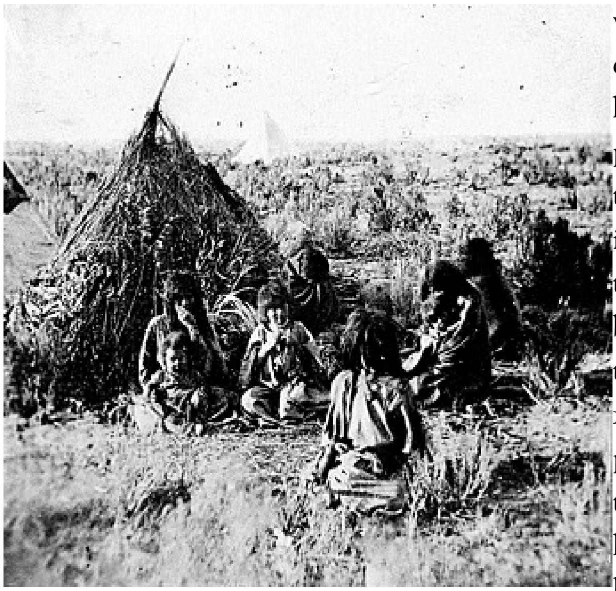
Chas Hathaway

What local materials did (or presently do) indigenous people use to construct their homes?

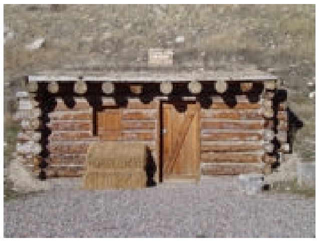
The Kanosh Band of the Paiute tribe of Native Americans is the earliest known people to inhabit the area of my site. Their homes were built of sagebrush, *Artemisia tridentata*, willow, branches, leaves, and grass brush shelters, as well as wikiups made from willow boughs and covered with grass, branches, reeds, and brush.[58] These were the earliest known people to inhabit the area, but in the 1850's, pioneers settled the area. During their first year here, prior to having a log-shipping system, they built homes by digging holes into the mountainside and building log cabins into the holes. Though I don't know for certain what these early structures were made from, Douglas fir, *Pseudotsuga menziesii,* is one of the most common large trees native to the area, and was therefore a likely candidate.



Paiute Wikiup



Bannock Tribe Brush Shelter



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[58] https://www.warpaths2peacepipes.com/indian-tribes/paiute-tribe.htm

What can we learn from the traditions on this land for modern design?

I think brush shelters and wikiups are a commonly overlooked building structure that, while perhaps not the best for housing families, can be a great shelter for animals, wind barrier for young trees/plants, and good shade for both. Also, the native American traditional medicines, foods, and cloths could be a powerful asset to modern design.

Which constraints and opportunities in your area did traditional materials address and how?

Sagebrush, a common building material, can take months to break down if left alone—in which time new sagebrush branches can replace the old. This would give native peoples opportunity to get through harsh winters in good shelter.

Willows are notoriously long and straight, making them excellent material for structures. Other local mustards, brush, and shrubbery can be dried to make effective windbreak and mild insulation.

Are there current constraints that these materials would help?

For me personally, financial constraints are very real and almost overwhelming. Out of necessity, I've had to build fencing, animal shelters, and shading out of branches, including many sagebrush and willow. We have the basic lifestyle of simple modern culture, but without the money to grow or better that lifestyle very much—other than through permaculture practices that don't need to cost money. Native people and cultures demonstrate that living on the land is not only possible, but sustainable, even without "money." Trade, patient harvesting, and creative experimentation, are all "technologies" that native people used, and that we can and should use today.

Local Network Survey

Chas Hathaway

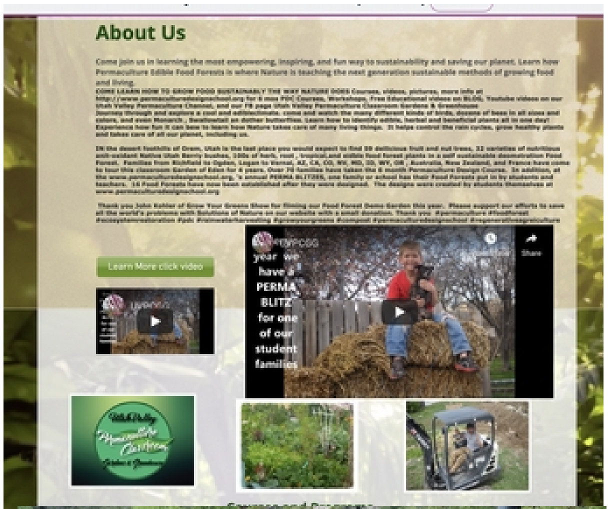
1. Research and list any permaculture, transition town, or like-minded groups in your area.

Though I can find no permaculture groups in my county (I'd like to start one in the not-so-distant future), there are a few groups in the county just north of us.

Utah Valley Permaculture:

http://www.permaculturedesignschool.org/

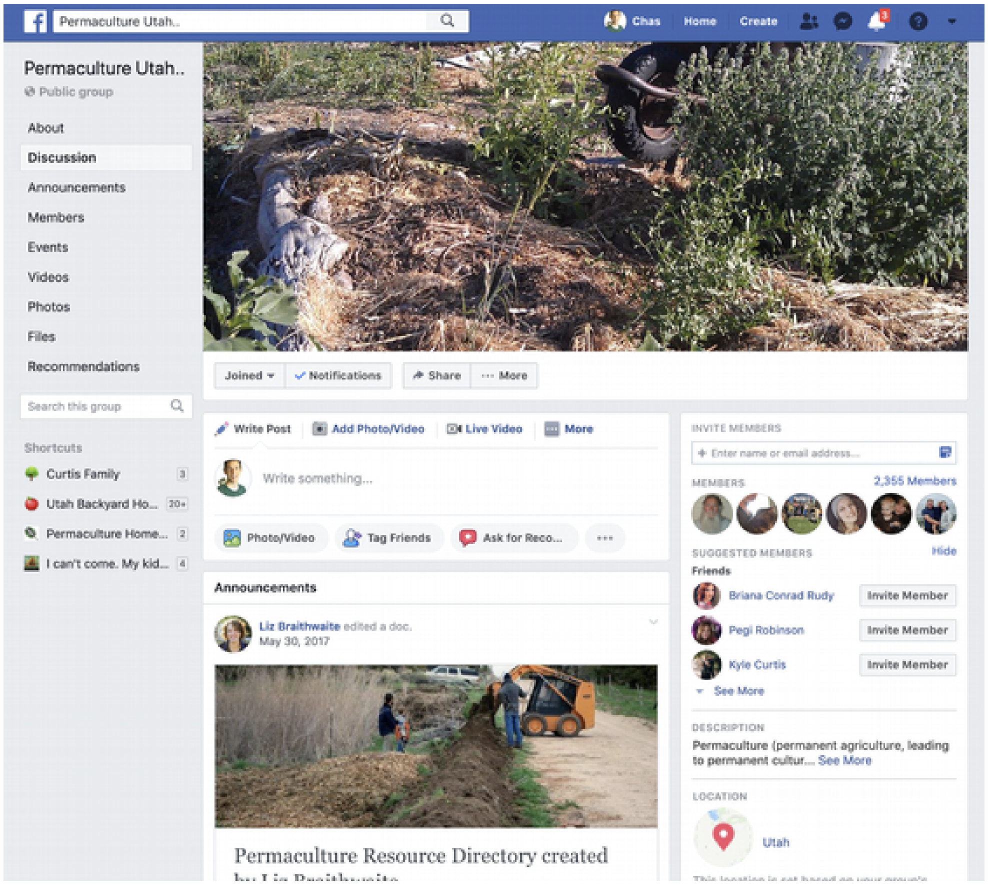
These guys run 6 month permaculture courses, collect and create videos, run workshops, and have an annual "perma-blitz," where teachers and students install a permaculture design for a family or school.



About Us

Come join us in learning the most empowering, inspiring, and fun way to sustainability and saving our planet. Learn how Permaculture Edible Food Forests is where Nature is teaching the next generation sustainable methods of growing food and living.

Safe Haven Village: I'm not sure it's fair to list this one, because from what I can tell, it's not still operating. But getting in contact with the group that organized it might be well worth the effort. SHV is a place where people have come together to build earth ships, a local, self-sustaining agriculture, and using the resources and energies of the earth to build a community.



Liz Braithwaite edited a doc.
May 30, 2017

Permaculture Resource Directory created

Permaculture (permanent agriculture, leading to permanent cultur... See More

Permaculture Utah Facebook Group: Though not an in-person group, this is an active, very useful, and very helpful group for permaculture in Utah. It's an active community (the announcement at the top is pinned—not the most recent post). And though I don't consider it as a full, social structured community, it does provide good info and resources regarding local ecology, permaculture events, and ideas.

There's also a local citizen's corps group that shares events and topics on various topics, and from what I've heard, permaculture is sometimes discussed. Once the class is complete, I intend to get involved.

2. List any instructors, mentors or practitioners (if they exist in your area) and what they teach in relation to regenerative living, agriculture, or permaculture. If you cannot find anyone in your area, where is the closest contact that you can find?

Caleb Warnock is an expert that specializes in self-sufficiency and sustainable homesteading. As the author of well over a dozen books on everything from winter gardening to baking with natural yeast, to self-sufficiency skills practiced by the early settlers of the American west, he's both well studied and has a great deal of experience in permaculture practices.

I got to know Caleb when he was publishing his first book through the same publisher as my book (my book was unrelated to this topic, but his was not), and if anytime someone asks me who to turn to for local expertise in permaculture and such, I point them his way.

List any active design or design/build companies that use permaculture or like-minded approaches in your area.

The only thing that I can find locally is the above mentioned Safe Haven Village. Unfortunately, all of my attempts to contact them to come and see their site have failed—disconnected phone number, the gate to the village is locked, and I can find no sign that they are active. In my mind, that makes them an even more interesting site to see, because if the site has been forgotten or ignored for several years, I'd be able to see the design after many years of neglect.

Utah State University has an extension that does a permaculture initiative. I have to look further into it, but there may be contacts there I can turn to as well.

With how many people here in my county are interested in the topic, but so few who have been through the training, this could be a real opportunity for starting something here in Sanpete county. I would like to find as many people locally who have been through PDCs and/or had hands-on experience with permaculture to see if we can start a Sanpete permaculture group.

Site Design

Plant System Design

Chas Hathaway

The portion of the project I've chosen to design for this assignment is the southwest windbreak area. In past attempts at plant guilds, I quickly found that I have to be quite flexible in what I do for a guild, because in one area there may be great success, while another has only one plant survive, and another no plants survive. I feel like telling the plants, "If you guys can just stick around for awhile, you're going to get along great!"

So I'll be flexible in the particular species selected, and where one species doesn't work, I'll find another to fill the same function.

For this southwest windbreak, I'm trying to "soften the blow" of the hard spring winds that come in and dry out the system, as well as provide late afternoon shade to cool the site earlier on. This windbreak is a much needed aspect to the whole system, as the winds dry the ground faster than the sun does. But if the design works, it should encourage the winds away from or above the most important areas of the system and provide shade, mulch, and other functions to help the rest of the system.

Southwest Windbreak Community

Major effort: to break/stagger the strong spring wind from the west that dries out much of the property, develop a thick natural "fence" to deter deer, and create a beautiful serene atmosphere for inhabitants.

Present view of Southwest Windbreak Community

Priorities (in order of importance)

1. Windbreak.
2. Deer fence/deterrent.
3. Perennial.
4. Provide material for fencing.
5. Provide building/project material.
6. Provide food, medicine, or animal fodder.
7. Provide natural rooting hormone for use throughout the site, as well as more pioneer species.
8. Give off nice smell (since wind comes from that direction, it's smell will probably permeate the property).

9. Provide late afternoon shade for west end of site.
10. Provide cover for cars in snowy winter.
11. Block trash and debris from entering site.
12. Block boring/unpleasant views
13. Provide easy quality mulch.
14. Encourage pollinator insects on to the property.
15. Drink up water that would otherwise run off the property in heavy wet winters.

Species to Include:

1. Globe willow: *Salix matsudana*, 70 feet (wide and high) and weeping willow *Salix babylonica,* 50-70 feet tall (30-50 feet wide)

Uses: Windbreak, fast-growing pioneer species, fence-building, natural rooting hormone, shade, leaf mulch, preventing water runoff, kid-climbing trees, medicinal for headaches, etc.

Layer: Canopy

Interaction with other plants in community: Globe and weeping willow will provide mulch for the honey locust, windbreak and partial shade for the smaller plants, and rooting hormone for duplicating plants in the community. (Mint, lemon balm, lilac, and thyme should especially benefit from this relationship.) The globe willow should also provide an under-path for people navigating in the community.

2. Honey Locust: (nitrogen fixer), *Gleditsia triacanthos*, 66-98 feet tall

Uses: Windbreak, nitrogen fixation, deer-fencing material (with thorny varieties), edible pods, animal fodder seed, and nitrogen-rich leaf mulch.

Layer: Canopy

Interaction with other plants in community: Honey locust is placed between willows to provide nitrogen for willows (and all plants in the community).

3. Lilac: *Syringa vulgaris,* 15-20 feet tall (up to 15 feet wide)

Uses: Natural deer fence, windbreak, beautiful scent, inviting pollinator insects, leaf-mulch, privacy barrier.

Layer: Understory

Interaction with other plants in community: Lilac will provide invitation to pollinator insects for the sweet pea, sunflowers, mint, lemon balm, and thyme.It will also provide windbreak for all smaller plants, and natural trellis for the sweet pea.

4. Sunflower: *Helianthus annuus,* (8-16 feet tall)

Uses: Trellis for sweet peas (until trees mature enough to climb), inviting pollinator insects, fence-building material.

Layer: Shrub

Interaction with other plants in community: Sunflower should provide a natural trellis for sweet pea, encourage honey-bee activity and other pollinator species for the benefit of the community, and provide a fence-like layer to discourage domestic birds from progressing further.

5. Everlasting Sweet pea: *Lathyrus Latifoliust*, (~6' tall and wide)

Uses: Nitrogen fixation, edible (and delicious) flowers, natural deer fencing.

Layer: Vine

Interaction with other plants in community: Sweet pea will provide nitrogen for the lilac and smaller plants. Sweet pea's deep root should help keep the soil pliable, and bring nutrients to the surface. It will also provide a yearly thick mulch layer for the trees, sunflowers, and lilacs.

6. Lemon Balm (*Melissa officinalis*) and Peppermint (*Mentha piperita*), (2-3 feet).

Uses: Deer deterrent, lovely scent, tasty leaves, insect deterrent.

Layer: Herb

Interaction with other plants in community: Lemon balm and mint should discourage chickens and insects from eating other plants in the community, partially by their anti-pest properties (scent, etc), and also by providing a thick ground layer to make navigation challenging for domestic birds.

7. Yucca: *Yucca filamentosa* (2.5 feet wide, seasonally 8 feet tall)

Uses: Natural fencing/deer deterrent, edible root tuber, stalks for fence and other building material.

Layer: Herb and root

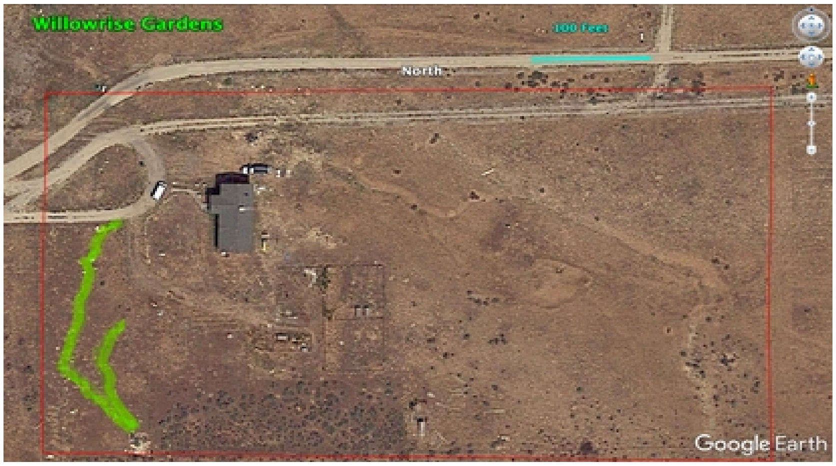
Interaction with other plants in community: Yucca should help keep animals away from the rest of the community, aerate soil with it's thick root, and provide partial shade for thyme.

8. Thyme: *Thymus vulgaris* (up to 1 foot)

Uses: Pizza seasoning, deer resistant herb, insect deterrent

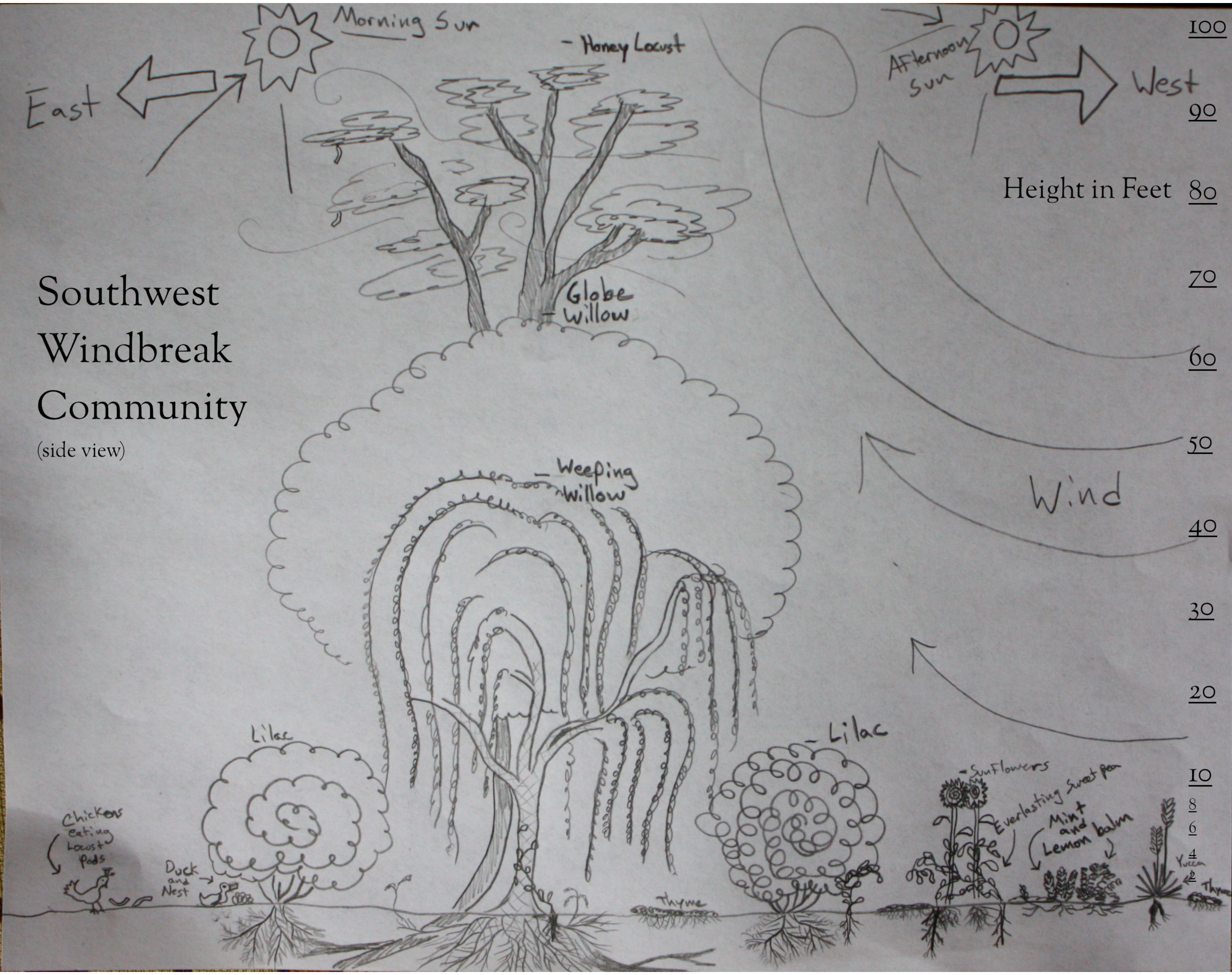
Layer: Ground cover

Interaction with other plants in community: Thyme should deter pest insects, maintain moisture at the ground level for the benefit of the smaller plants, and provide a light yearly mulch for the whole community.

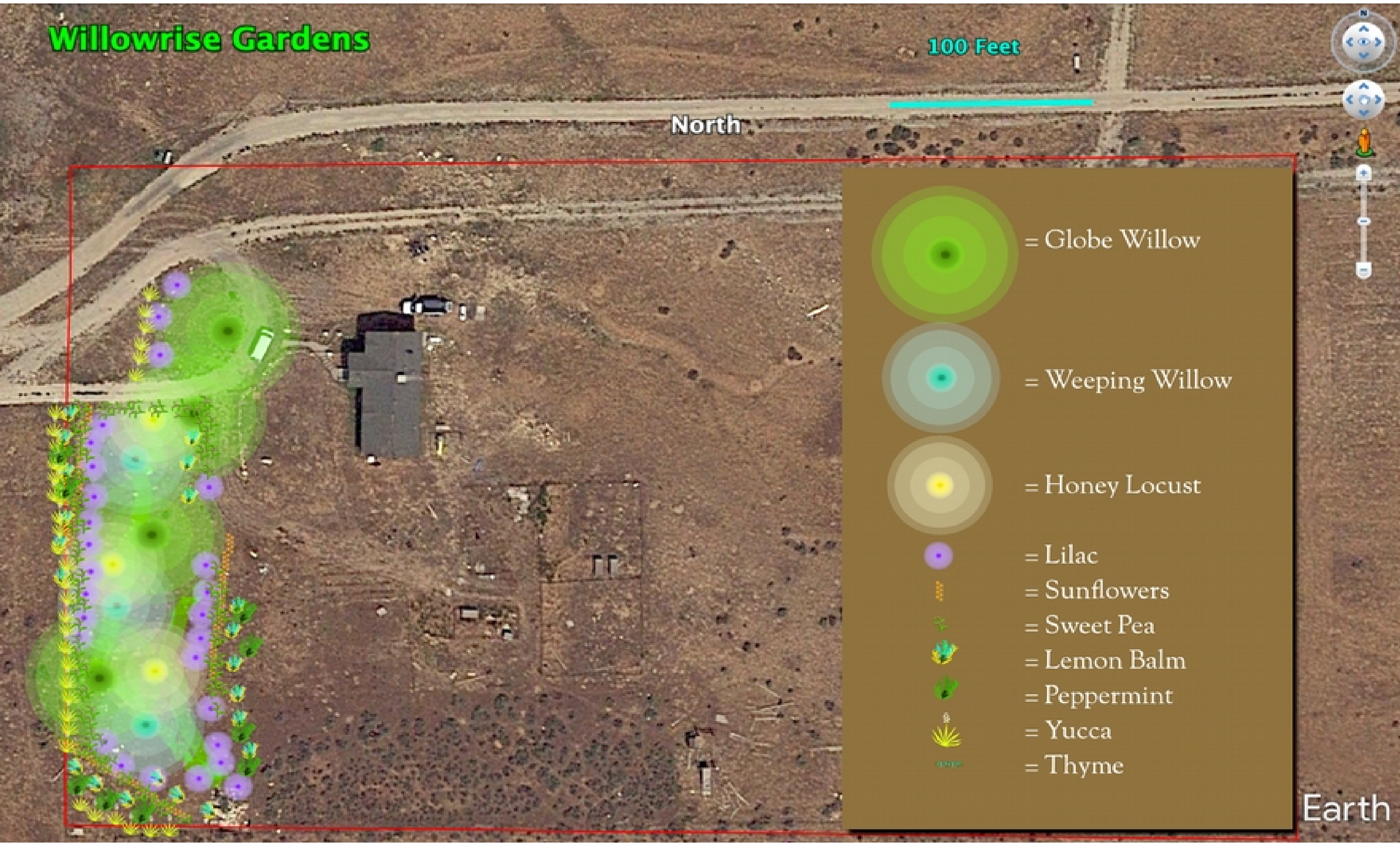


Green line indicates the contour-based location of the SW Windbreak Community as it looks now

Side View of the Soutwest Windbreak Community



Top (Plan) View of Southwest Windbreak Community



Establishment plan for the Southwest Windbreak Community

The SW Windbreak Community follows a contour line where I will put in a small swale to facilitate watering for the community. Using either drip or very light hose-stream, water will run into the swale, where willow trees will be planted via cuttings—poked right in the base of the swale, in order to ensure the most water access, as well as allowing them to capture snowmelt and rainfall. After they root and begin to really grow, their shade will facilitate the growth of both lilacs and honey locust, which will first be planted downhill of the swale.

Honey locust will come from store-bought plants and possibly branch clippings for rooting.

Lilacs will initially come from several store-bought plants, as well as *many* clippings from locally-grown lilacs that have proven hardy in this climate. As some lilacs grow, clippings will be taken for propagation of more lilacs in order to obtain the desired quantity.

As these pioneer trees begin to grow (especially willows), sunflowers will be planted right away to provide some protection and windbreak for young pioneer trees. Once the first years sunflower stalks are grown, everlasting sweet pea will be planted (mostly from seed, but possibly some from cuttings if possible) to climb the finished stalks. Seeds from first-year sunflowers will be planted again the following spring to perpetuate sunflower succession. As trees begin to provide partial shade to outer perimeter of the community, mint, lemon balm, and thyme will be planted from cuttings rooted near the base of the young willows (to assist in rooting), and worked outward until other plants in the system are mature enough to fulfill their intended functions.

Since willows grow significantly faster than honey locust and lilac, willow starts will initially be planted very close together. The healthiest trees best fulfilling the shade/windbreak function will be encouraged to grow, while others will be coppiced for root-hormone and light fence material (including any needed trellising for others in the community). As trees begin to get even bigger, the best trees will be encouraged still, while others will be coppiced to provide thicker wood stalks, fence posts, tool handles, etc.

Eventually sunflowers may be unnecessary to the community, and so will be encouraged to succeed naturally only (fizzling them out of their purpose in the community, but continuing to offer benefits elsewhere by the spreading of their seed via birds, squirrels, etc).

Once the community is fully established, it is hoped that only minor effort will be required to maintain it, but the community should continue to provide the intended benefits indefinitely. At that point, traversing the community will be by walking under the canopy trees or outside of the main line of foliage.

Perhaps one day we'll put a picnic bench and tree swing under the canopy for family get-togethers.

Zone 1 Design

Chas Hathaway

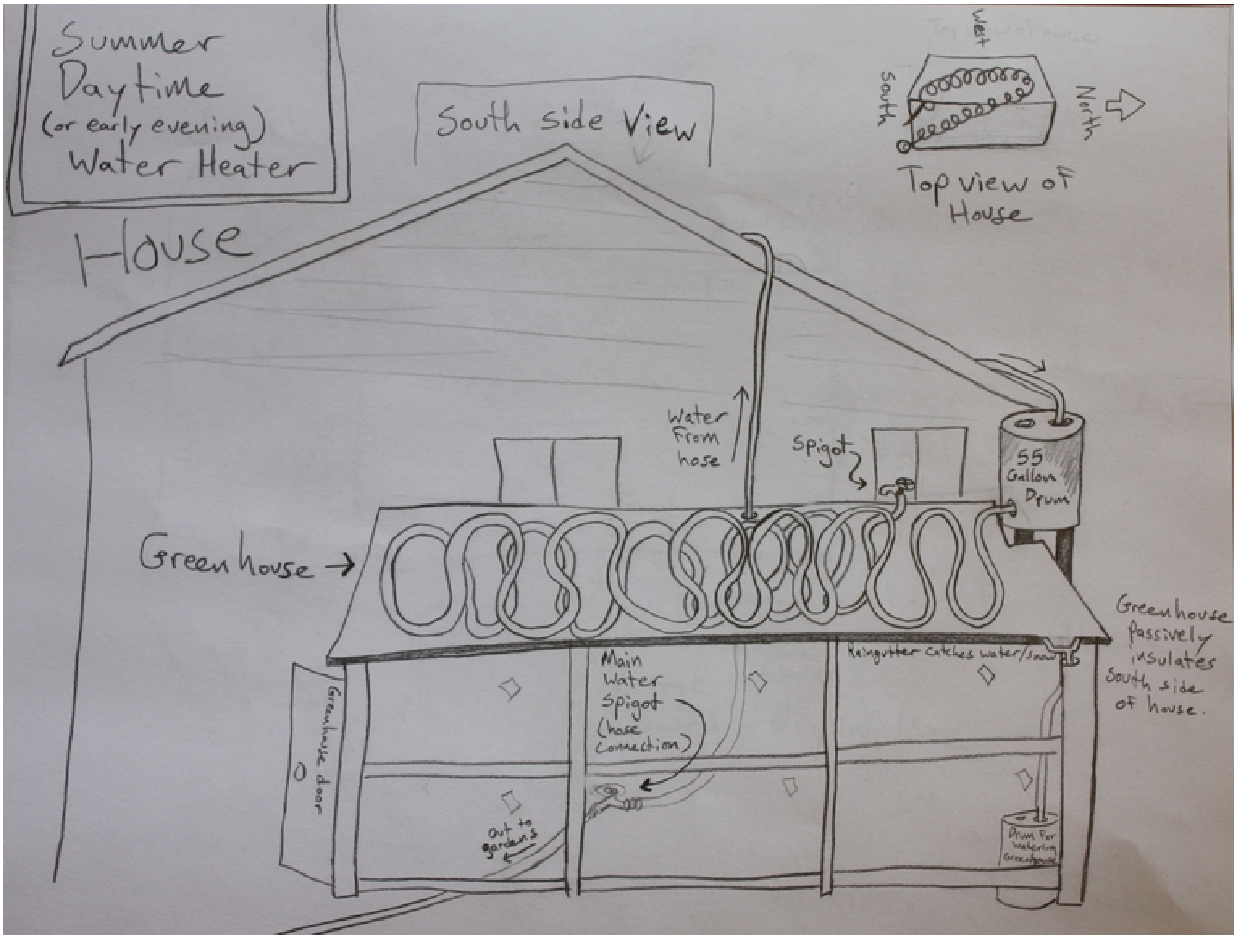
360° Energy Surrounding House

Tree Insulation/Shade

The front of the house (west side) will have dwarf fruit trees, tall enough to shade summer sun from the front windows, helping the house maintain coolness into the afternoon. In winter, these trees will be dormant, and without leaves, winter sun will come easily into the windows, helping warm the house some.

Summer Water Heater and Greenhouse

The south side of the house (by far the warmest side all year round) will be covered partly with a greenhouse, which has a full metal roof (no transparency about the roof), and glass for walls (90° angle to keep maintenance and cleaning easy, and to keep kids from leaning on or climbing up the glass). These


Summer Daytime (or early evening) Water Heater
South side View
West
South
North
Top view of House
House
Water From hose
Spigot
55 Gallon Drum
Greenhouse →
Greenhouse passively insulates South side of house.
Greenhouse door
Main Water Spigot (hose connection)
Raingutter catches water/snow
Out to gardens
Drum for watering Greenhouse

glass walls will be 5 feet tall, with a slanted roof that slopes up toward the house, allowing plenty of sun in cold seasons, but blocking out most sun in summer. Water caught on this greenhouse roof will go through rain gutters and collect in water barrels for watering in the greenhouse.

On top of this greenhouse roof will run 100 feet of black plastic hose, which will have a spigot right outside the bathroom window. This spigot will be used to fill the bathtub with hot water for bathing.

This hose will loop on the roof, catching sun, and will be fed water from a 55-gallon drum of water attached toward the top of the greenhouse roof. This drum will be either painted black (to absorb heat) or insulated to retain heat (more research to come on this), and will be fed water coming from a black plastic hose running onto the roof. That hose will loop several hundred feet along the roof, allowing the many gallons *in* the hose to heat up considerably, and will be fed its water from the outdoor water spout.

When someone is ready in the afternoon or evening to take a bath (it wouldn't be hot if they bathed in the morning), they would simply open the window and turn on the spigot to drain hot water into the bath, and then go turn on the outside hose to replenish the water being drained. Once the bath is sufficiently full, they will turn off the outside water, and then come in and turn off the spigot in the window.

Obviously this will only work in the warmest seasons, but since we have at least a couple months of *really* hot days, it could cut our propane bill for those months considerably. Another spigot may be installed for doing the dishes in the summer, too.

Clothesline

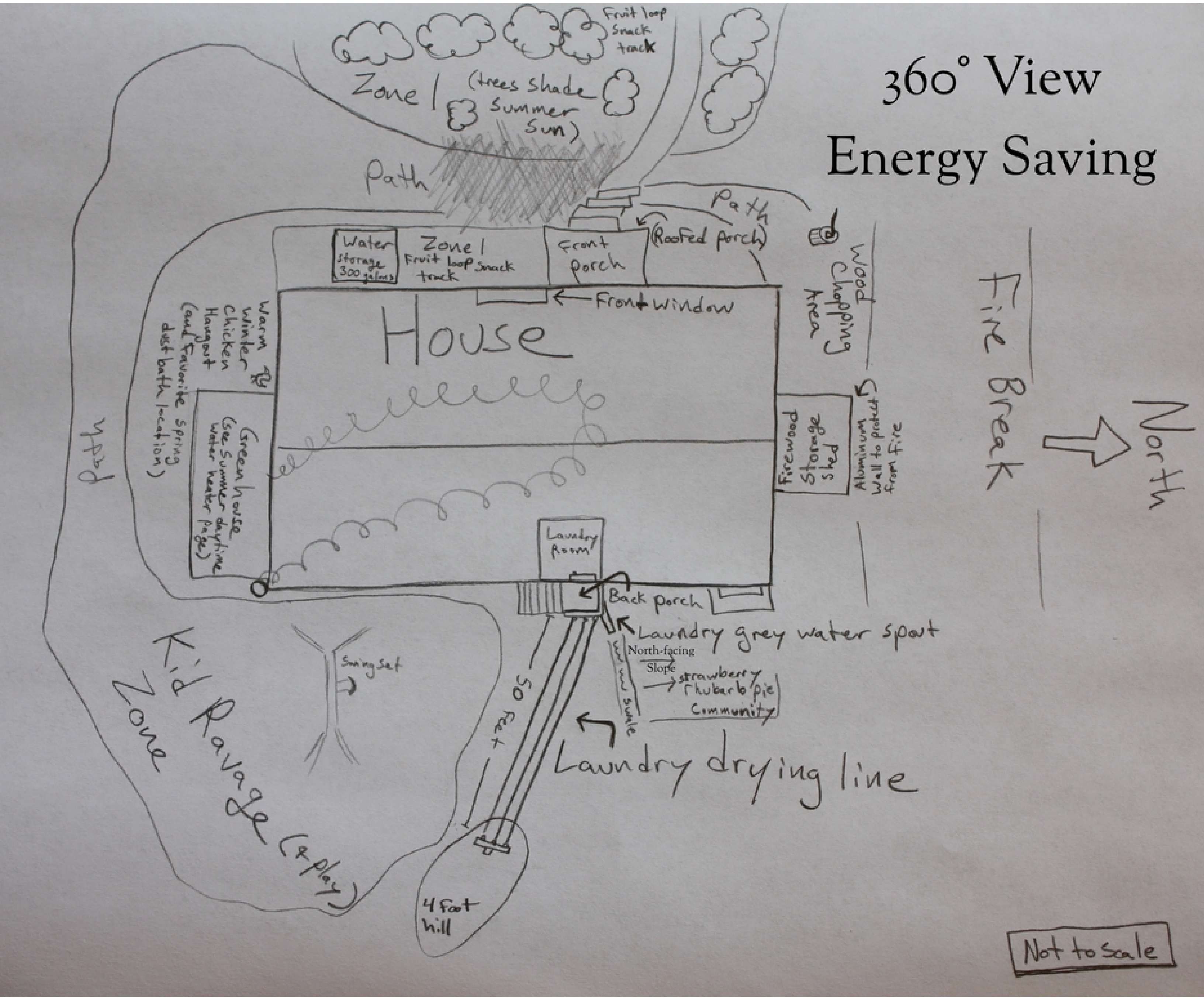
On the east side of the house, just outside the laundry-room door, we'll have a back porch installed, from which the clotheslines will run outward with a pulley system so a person can hang the laundry without having to leave the porch. These lines are high in order to discourage child-tampering with the line, as well as prevent people from getting clotheslined (ouch!) in dimly lit hours even if some heavy laundry remains on the line.

Fire-Wood Preparation and Storage

On the north side, wood will be chopped, and then stored in a wood-shed that is lined on the north side with aluminum wall (roof material) to prevent fire—it being right on the edge of our fire break area.

So our full 360° energy saving system should look something like this:

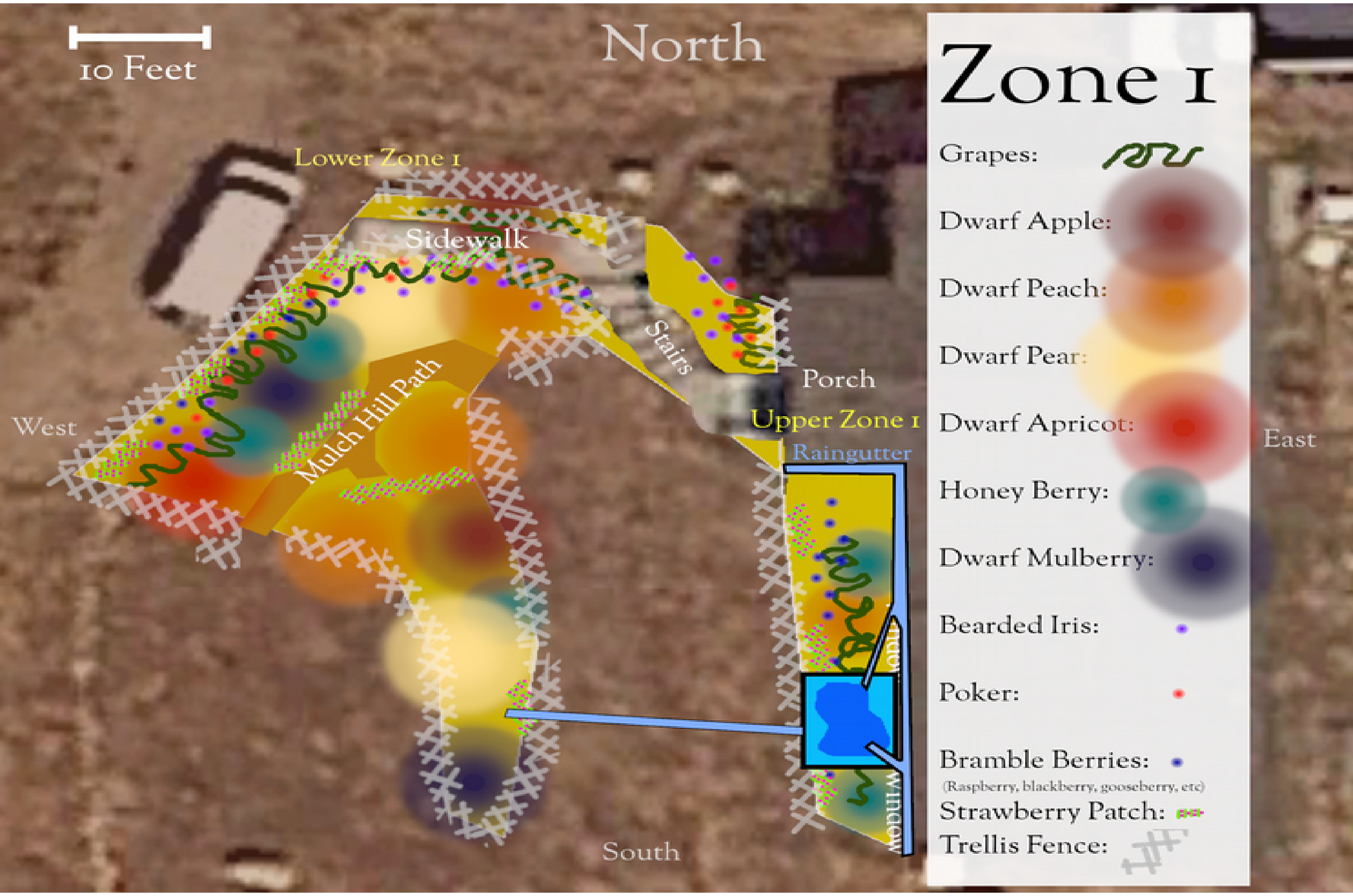
360° View Energy Saving



Zone 1 Design

Though Zone 1 will be the most "public" area, where most people will see, I'm less concerned about visual aesthetics, and much more interested in fruit yields. And I love the idea of snack paths. I'd like to make our zone 1 a snack path where mature plants are offering (almost) year-round fruit, so we can invite visitors to snack on their way in, or on their way out to their car.

I'd like to have enough variety of fruit-types to cover all the non-frozen months, ensuring that at any time of year besides winter (even winter if we can find something appropriate), there is *something* fruiting and available for snacking.



Since the entire area making up zone 1 is slightly raised from the sidewalk and lower elevation area, I will be sinking the bed to help retain water. Sunken beds have always worked better for me than raised or flat beds. Also, I will have a swale feed into the section of zone 1 that doesn't touch the house (lower zone 1).

I'm also insisting that the major design plants in zone 1 all be perennial.

Water Source

The primary water source for zone 1 will be front roof water runoff catchment, which will be caught using rain-gutters emptying into a 300 (or so) gallon covered recycled hot-tub. Water will be drained onto the upper zone 1 using a large spigot, and also siphoned from the top of the hot-tub, as needed.

Excess water will run into ditches running parallel to the house, and then into the lower zone 1 swale, and I will have a pipe running just under the ground gravity feeding water into the lower section of zone 1. The lower section will also have a swale which runs a hundred feet or so down the property on contour to collect water for lower zone 1.

Paths

The lower section of zone 1 will have a raised mulch path, and lowered garden beds, where the plants and dwarf trees will grow. The upper section, being only 8 feet wide, will have stepping stones placed to be able to reach all necessary areas.

Fence

The entire zone 1 will have to have fencing to keep children (as well as deer, chickens, ducks, and squirrels) out, probably chain link or other trellis-able fencing in order to protect the main part of the plant, yet allow people to reach through or over the fence to get fruit. This will probably involve fencing that is small at the base (to keep out squirrels, etc) and large holes at the top, to allow reaching in, but keeping deer out, and go at least 8 feet high.

Cyclical Fruiting

In order to have fruit available throughout the growing seasons, I have chosen species and varieties that fruit in different months, so that when the first is done fruiting, the second has already begun to ripen. The fruits selected for this zone include:

Honeyberry *Lonicera caerulea* (Fruits in May)

Dwarf mulberry *Morus alba* (fruits in June)

Dwarf Apricot *Prunus armeniaca* (ripens June-July)

Bramble berries *Rubus* species (raspberries, blackberries, etc—fruits from June-August)

Dwarf Peach *Prunus persica* (fruits July-August)

Dwarf Pear *Pyrus ussuriensis* (fruits August-October)

Grape *Vitis vinifera* (fruits September-October)

Dwarf Apple *malus pumila* (fruits September-October),

Ever-bearing Strawberries *Fragaria vesca subsp. vesca 'Alexandria'* (fruits throughout the growing season). These would be kept on the north, east, and west sides of zone 1, so as to allow them partial shade.

As part of keeping their growth height down, and in order to encourage fruit production, branches will be pruned annually in a chop-and-drop fashion, providing a level of spring mulch. Also, once the leaves have fallen in autumn, chickens (and possibly ducks) will be allowed a brief visit in zone 1 in order to scratch and eat any bore-worm larvae, to aerate the leaf mulch, loosen the soil, lay a bit of manure, and prepare the area for winter dormancy.

Grape System

I have long wanted grapes, and there are two varieties that would likely do very well here:

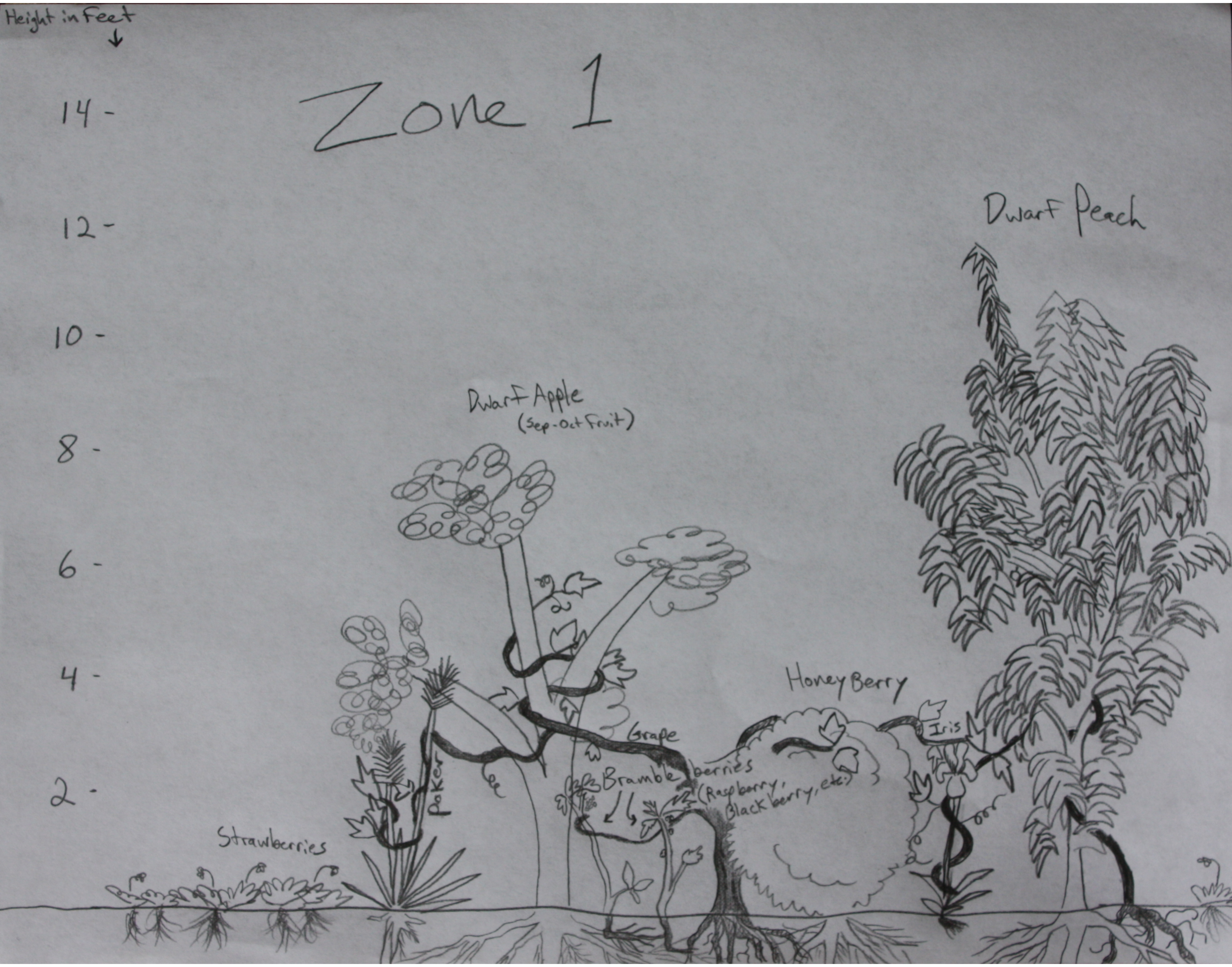
Beta Grape, hardy to zone 3, self-fertile.

Bluebell Grape, hardy to zone 3, self-fertile.

These varieties should fruit in the summer, and so there will also be planted some tall-stalk perennial bulb flowers to provide some lower trellis, and then the dwarf trees will become the trellis for the higher sections of the grapes. Trellis flowers (which will have finished their flowering and have finished stalks by summer) include:

Pokers (for natural trellis), AKA Torch Lilly, *niphofia uvaria*, blooming May-June (done by summer)

Irises (for natural trellis), *Iris germanica,* March (done by summer)



Other Species

I would also like to include several bramble berries, such as raspberries, blackberries, gooseberries, and thimbleberries. Depending on the success (or lack thereof) of other species already listed, I may also include elderberry, goji berry, yucca, among others.

Willowrise Gardens

Permaculture Site Design

Chas Hathaway

Mission Statement:

The mission of Willowrise Gardens is to create a forested landscape of food and other resources, and a joyful place for people to live, in the hopes that the land will be passed on for generations to provide our descendants a model of what is possible in their own landscapes, as well as a source of plants, food, and seed with which to build those landscapes.

Goals:

Goal 1: To design the perennial landscape such that if left and ignored for 100 years, people might return to find it still producing food and resources in abundance. I think we can get it to the point where the site would be ready for such an "ignoring" within thirty years.

Goal 2: To provide an abundance of perennial fruits and vegetables—preferably enough to meet the basic fruit and vegetable needs of a family of eight, with some to share. Ideally, we would reach this goal within ten years.

Goal 3: To have a lush food forest that looks like a thick, natural landscape. It is hoped that this will be the case within twenty years.

Goal 4: To become water independent as far as the landscape's needs are concerned—basically designed such that once fully established, the land won't require manual watering from the well. I anticipate this taking about thirty years.

Goal 5: To have a fun atmosphere for family to visit, including grandchildren someday; a place where camping can take place and feel as natural and fun as camping in the mountains. The aim is to have it at this point within fifteen years.

Goal 6: To produce sufficient wood on the property to provide all the heat for the home via wood-stove through the cold months. This will likely take at least thirty years—possibly closer to forty.

Goal 7: To develop a family burial plot where people can (if they choose) be buried at no cost, and loved ones who are buried here can have a tree planted on their grave as a memorial. Those wanting to be buried here will indicate what kind of tree (or bush, or whatever) they want on their plot. This should be able to be accomplished within 5-10 years.

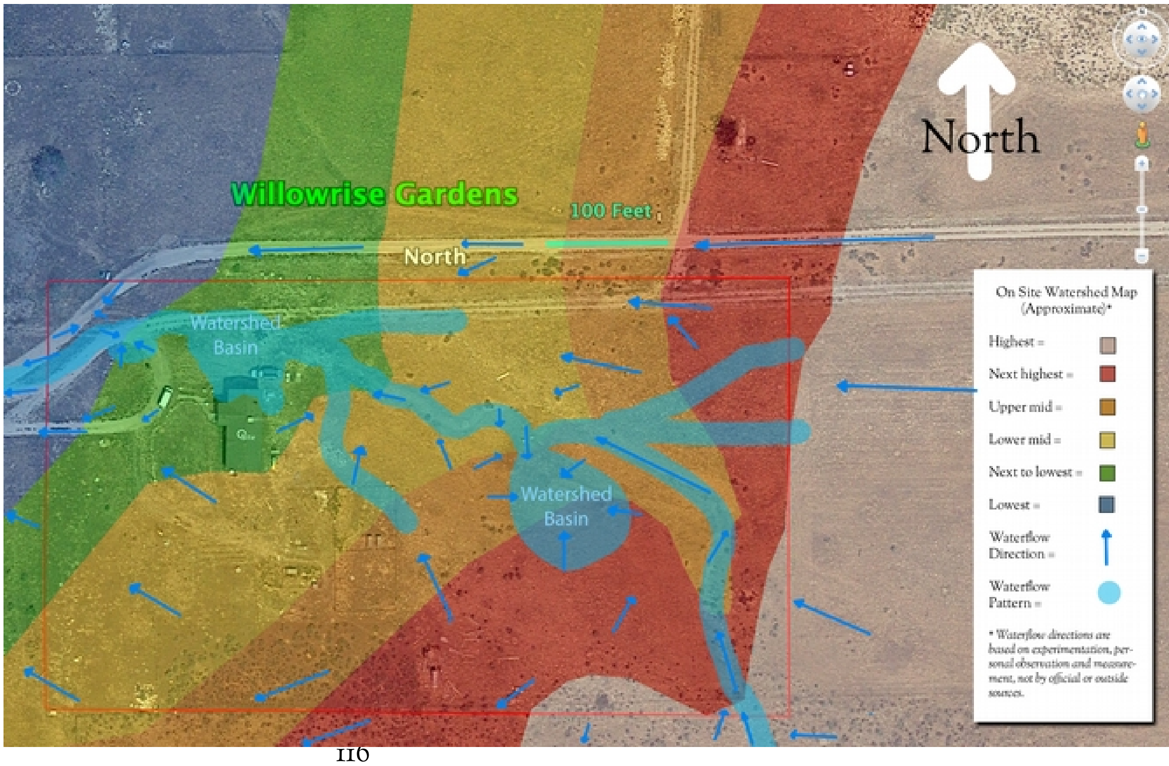
Goal 8: To develop a few passive energy harvesting systems to provide some of the electrical, hot water, and fuel needs of the house. We anticipate this taking about 15 years.

Goal 9: To find creative and enjoyable ways to make an income from the landscape. This should be possible within two years.

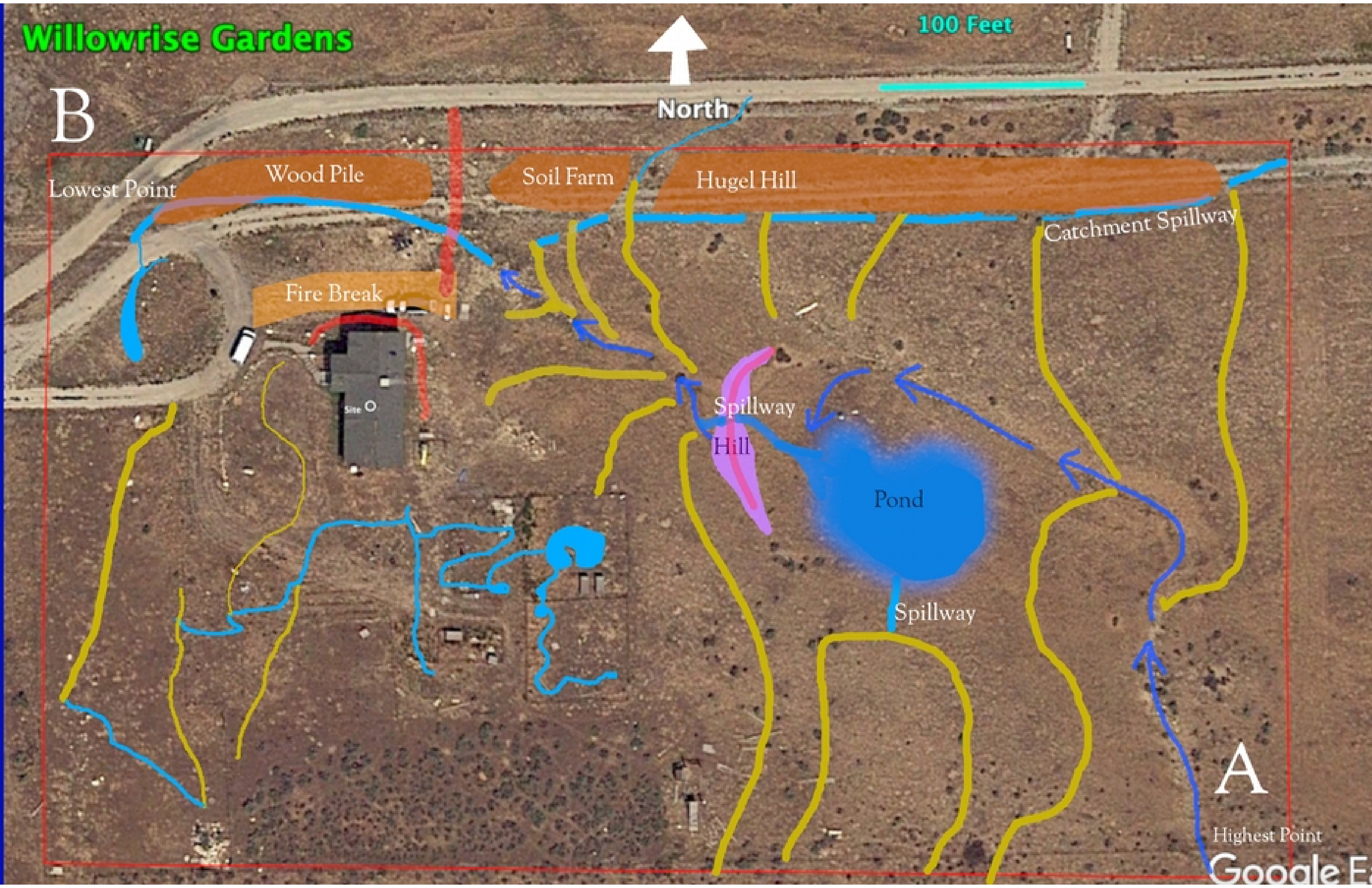
Goal 10: To provide an example of what can be done with sustainable agriculture locally, so that in teaching permaculture principles, I can point to our site and demonstrate what success can look like in this climate and location. This should be possible within three years, but will get better with each following year.

Water Flow

The way water flows on the site *presently* is as follows:



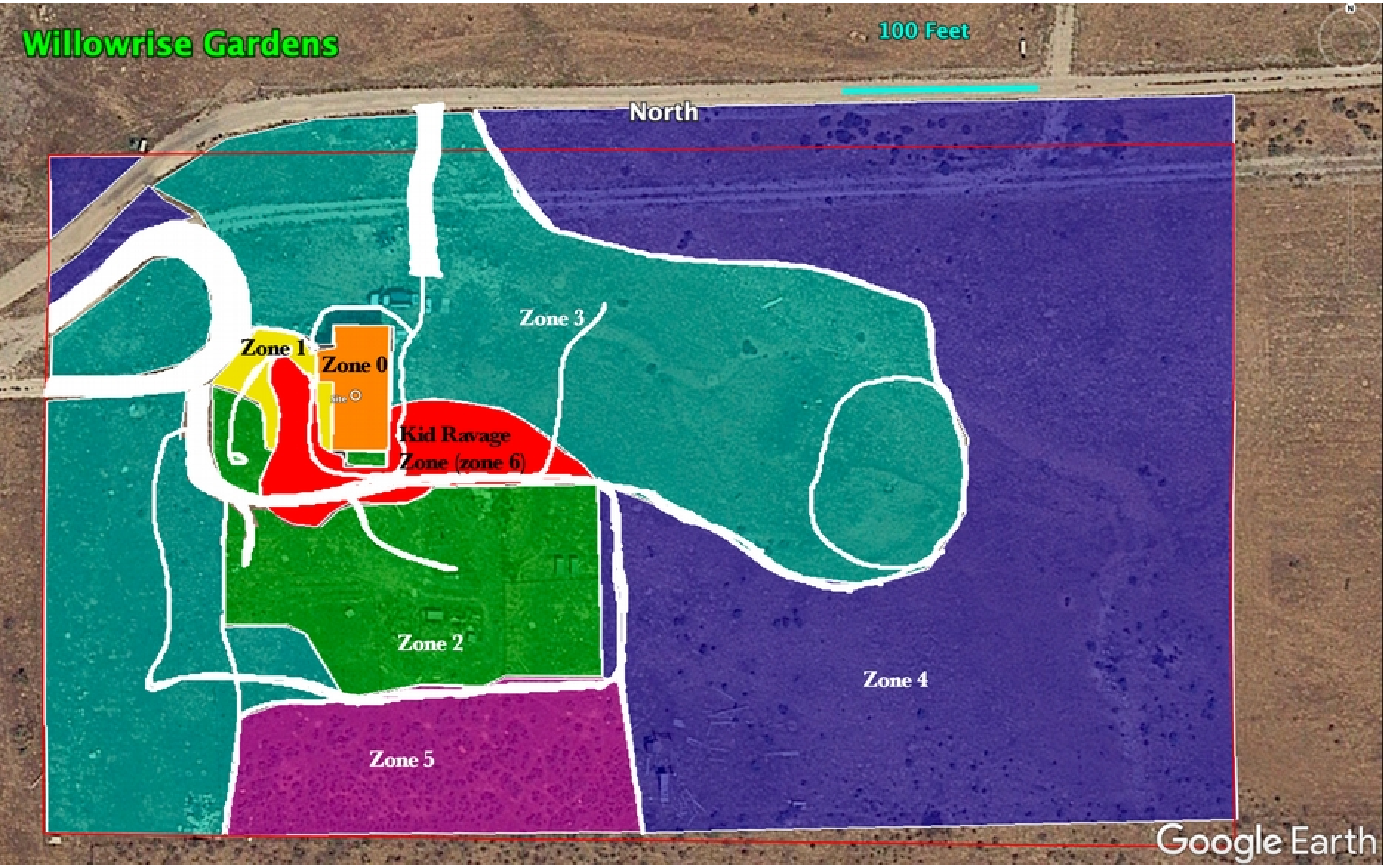
Once the full design is implemented, it is anticipated that the water will flow as follows:



Dark blue lines: A natural runoff stream (completely dry, but probably once seasonally flowing prior to higher-elevation farms and croplands). The site runs from high point A to low point B.
Yellow lines: Swales on contour. These will slow the water, and in the event of exceptionally wet runoff or flood, will divert water into pond or heavily planted water-way (blue arrows). These do not "flow" into the pond, since they are level, but if water rose hight enough, they would spill into the next elevation level down.
Light blue lines: Water spillways intended to move overflowing water into the next swale, pond, or lower elevation water feature. Also representing water paths for flowing water to zone 2 trees when necessary.

New Zones and Pathways

In the new design of the site, it is anticipated that the zones will look like this:



White represents pathways, and zones are represented by the colors in which they are shown.

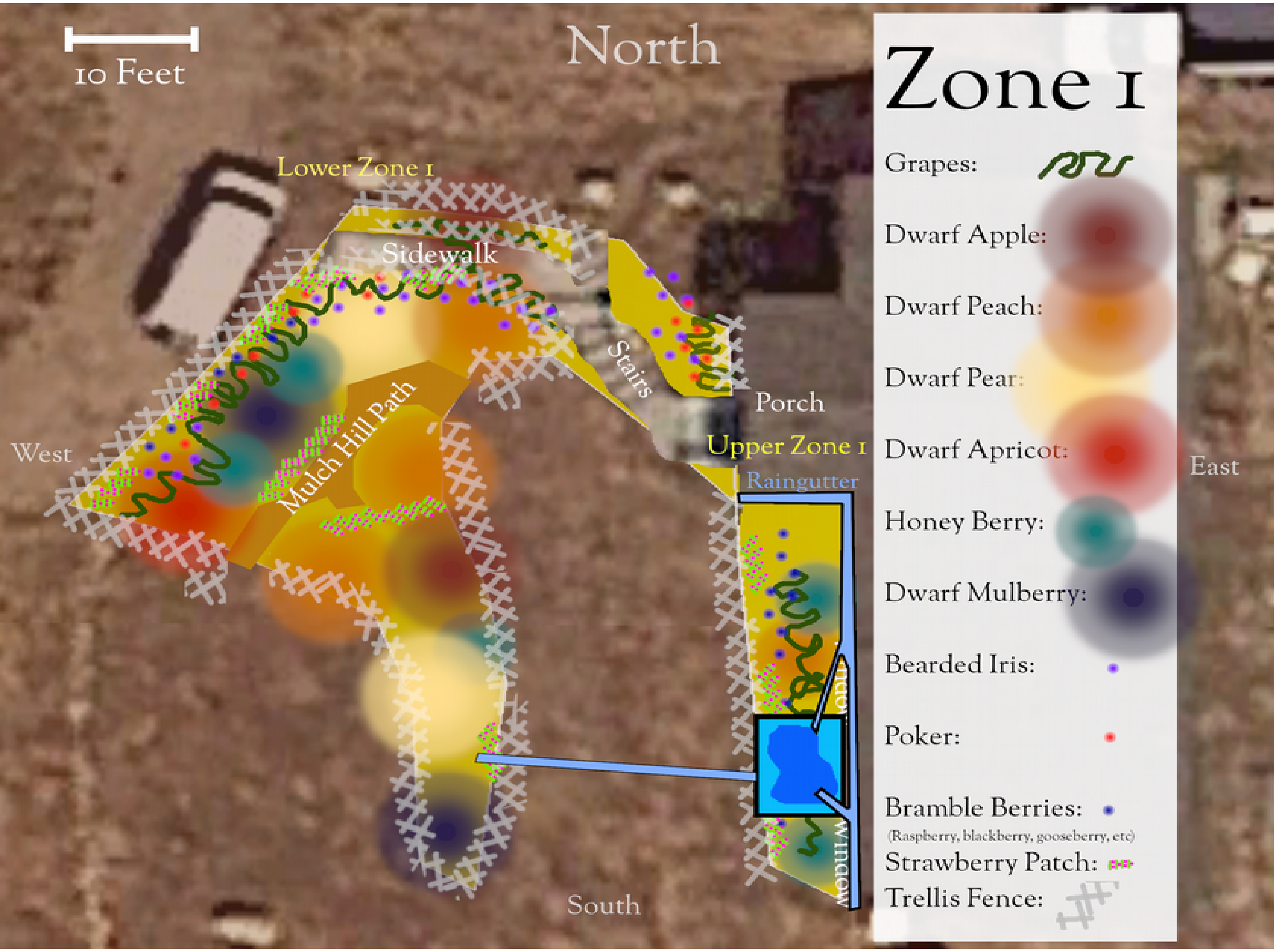
Zone 0: The Hathaway Hive

Though most of the house will be for family living, there will be plants adorning windows in the kitchen—most of which will be herbs, vegetables, spices, and other useful plants for kitchen/cooking.

Also, in the downstairs east-side is a garden room that receives a couple hours of direct morning sun. This will be used to sprout young plants, grow a few tropical indoor plants, and act as ferret housing for our ferret(s), who do the invaluable job of keeping the house clear of mice (and a marvelous job of it ferrets do, too—even better than cats). Most of the mice we've had in the past have been deer mice, come in on cold or wet days. Ferrets are also entertaining and playful.

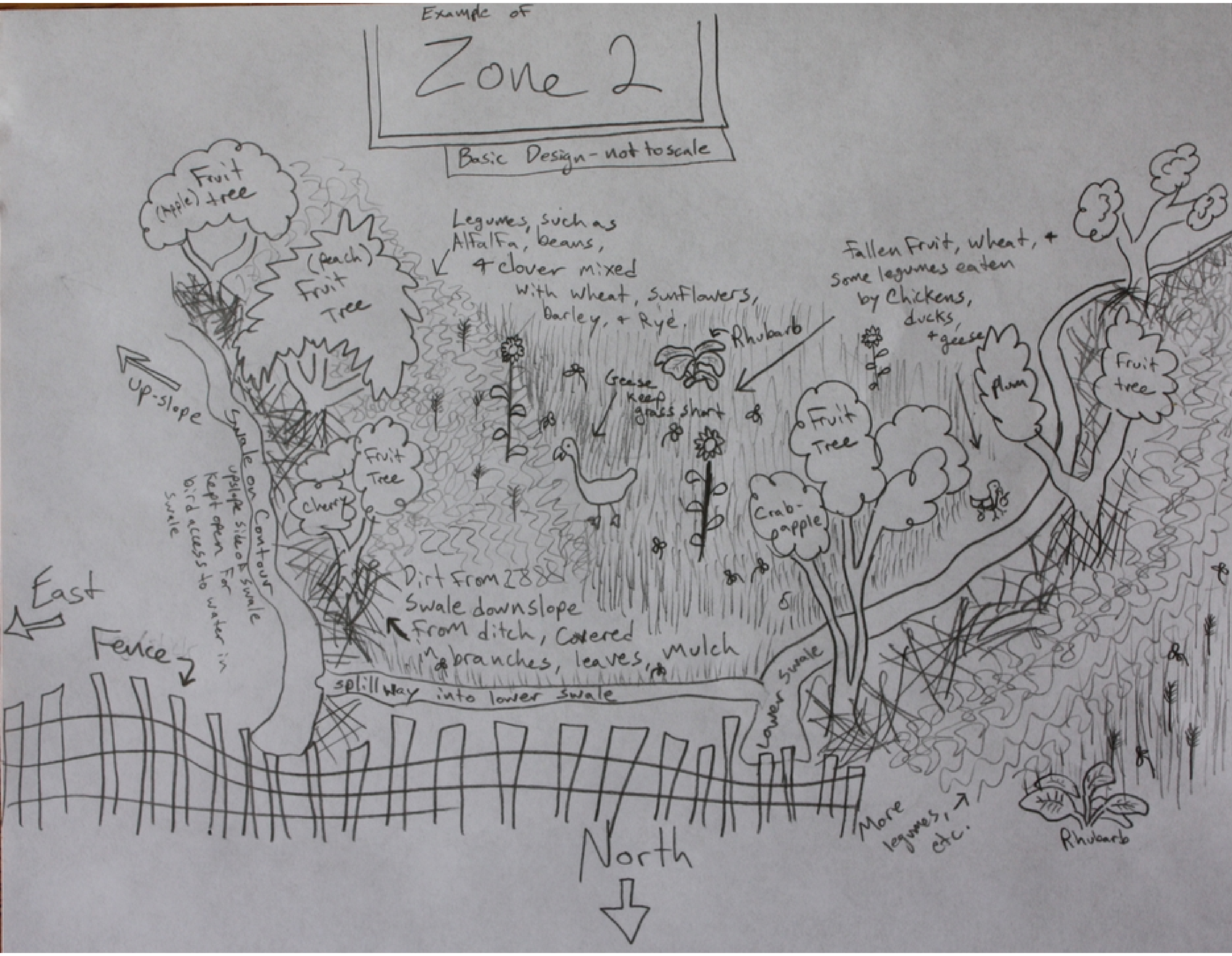
In this garden room, a large planter (perhaps eight foot by eight foot, three foot tall) will hold a small indoor forest of all the indoor plants we can get in there, including lemon trees, herbs, tomatoes, pineapple, banana, etc.

Zone 1: The Fruit Loop Snack-Track



Zone 1 is focused on easily reachable fruits blooming throughout all the growing seasons. The "loop" refers to this cyclical fruit system, where the first fruits may be ripe in May, the next in June, the next in July, etc. It's to be a snack track, because nothing grows so high that fruit can't be reached. There will be several dwarf fruit trees that will take careful pruning to maintain, but that pruning will also encourage fruit growth and robust size. It will be watered by roof catchment, and will have a mulch path going through it, which will lightly feed the soil whenever it rains or snow melts. This area will be fenced well enough to keep all but the smallest or best-climbing animals out (especially children), but it is anticipated that there will be enough fruit growing through and over the fence to provide any passerby a tasty snack. The entire area will be sunken down 8-12 inches lower than the surrounding paths and zones in order to encourage water retention and some wind protection for small plants.

Zone 2: The Forest Orchard


Example of
Zone 2
Basic Design - not to scale
Fruit (apple) tree
(peach) Fruit Tree
Legumes, such as Alfalfa, beans, + clover mixed with wheat, sunflowers, barley, + Rye.
Rhubarb
Fallen Fruit, wheat, + some legumes eaten by chickens, ducks, + geese
Geese keep grass short
Fruit Tree
Plum
Fruit tree
Up-slope
Swale on Contour
upslope side of swale kept open for bird access to water in swale
Fruit Tree
Cherry
Crab-apple
Dirt from swale downslope from ditch, covered w/ branches, leaves, mulch
East
Fence
spillway into lower swale
Lower swale
More legumes, etc.
North
Rhubarb

This zone is also focused on fruit trees, though these trees will be encouraged to be large and produce in abundance. These fruits will be not only for personal/family production, but for income. Thus great variety will be encouraged in order to provide both likeliness of some successes with each season, as well as more product for potential customers. Trees will be planted approximately ten feet apart to ensure enough successful trees, but if necessary, some trees may be pruned back, moved, or compassed to make way for hardier, better bearing trees. Some such “duds” may be pruned small enough to be reachable by domestic birds as forage. However, it is anticipated (from prior failures) that only a few trees out of every ten will survive long enough to become real fruit trees, and dead trees, as well as patches where fewer trees survive, will be planted with more fruit trees.

Leguminous herbs such as alfalfa, clover (especially *Trifolium pratense*), and various beans will be planted in thick patches to provide nitrogen to fruit trees. These legumes will also act as protein forage for the 10-15 birds (chickens, ducks, and geese) free-ranging on the property. Russian thistle will be encouraged to grow immediately around the base of the tree for it's ability to provide a thick, thorny "fence" around the base of the tree to protect from scratching talons and nibbling beaks. Though the birds don't tend to do major damage to the trees, Russian thistle ensures they give it a wide berth. Russian thistle will stay until the new generation grows through it, strengthening and reinforcing the barrier.

This zone will also have several wikiups for animal housing/shelter, and vines such as Virginia creeper, grape, and everlasting sweet pea will be encouraged to climb and engulf these wikiups, reinforcing their shelter and providing shade and windbreak for the domestic birds.

Sunflowers and Jerusalem artichoke will be grown throughout zone 2 to provide seed for bird (wild and domestic), and the Jerusalem artichokes will provide food tubers for people.

Zone 2 will also have hugel hills (hills of buried wood), and several small ponds (between three feet across and 20 feet across), used both for goose/duck needs and to water trees. Most tree plantings will follow micro-swales on contour (maybe a foot deep and a foot tall), and organic material will be piled on and around the swales. Runoff from duck and goose ponds will run into these swales, feeding the trees with their watered-down manure.

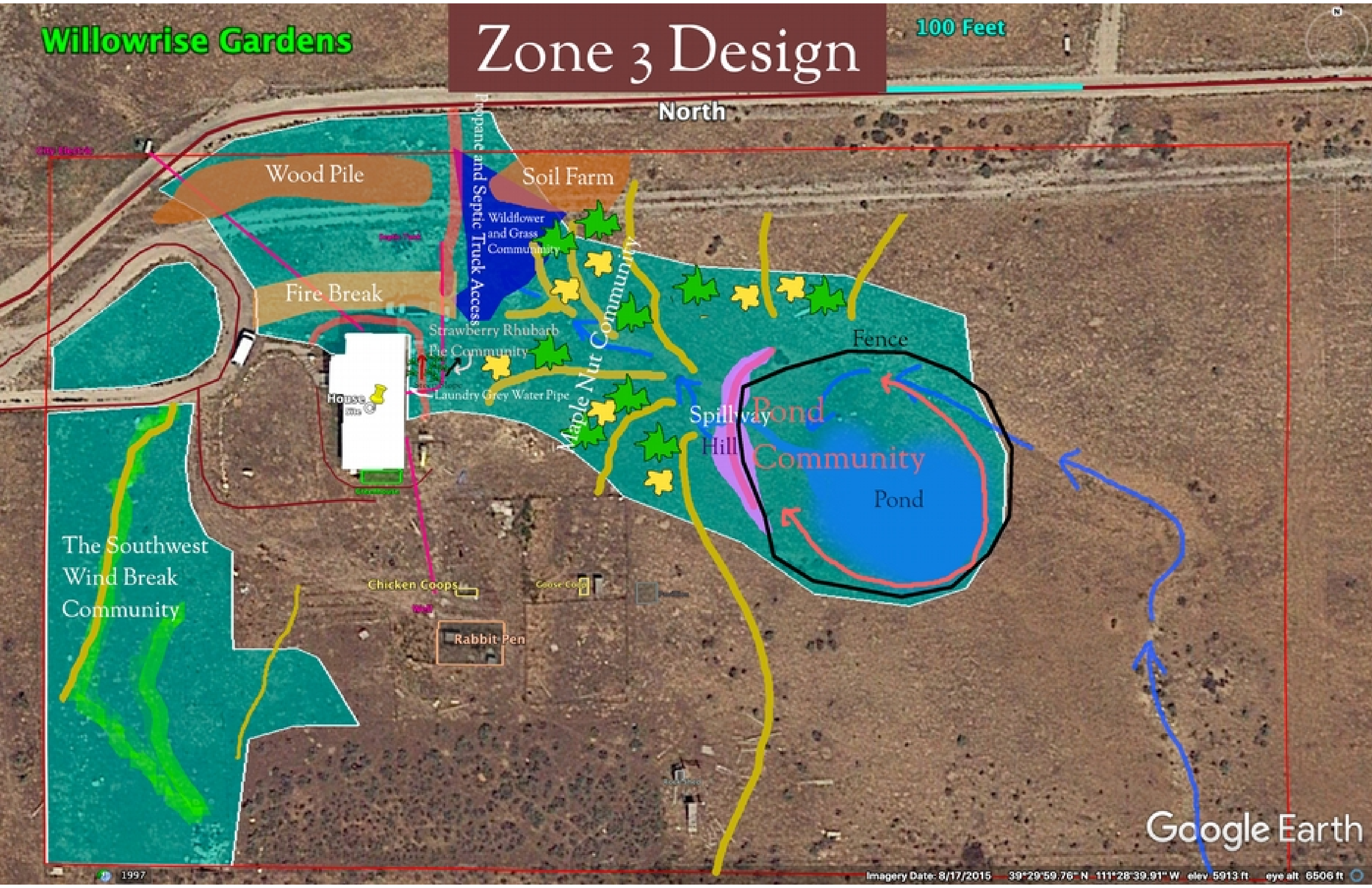
In the areas of the zone less trafficked by birds, raspberry, gooseberry, currant, elderberry, and other bush/vine berries will be planted. These will need protection until established, since birds will eat the whole plant while it's young.

Also included in zone 2 will be a protected (fenced off from chickens) hardy vegetable garden, with deep green veggies such as chard, leafy mustard, beets, carrots, parsley, radishes, lettuce, cabbage, garlic, and onion. The idea is to grow potentially self-seeding biennials, from which we will gather some seed to plant the following year, as well as to spread into wilder areas for passive, wild veggie harvesting.

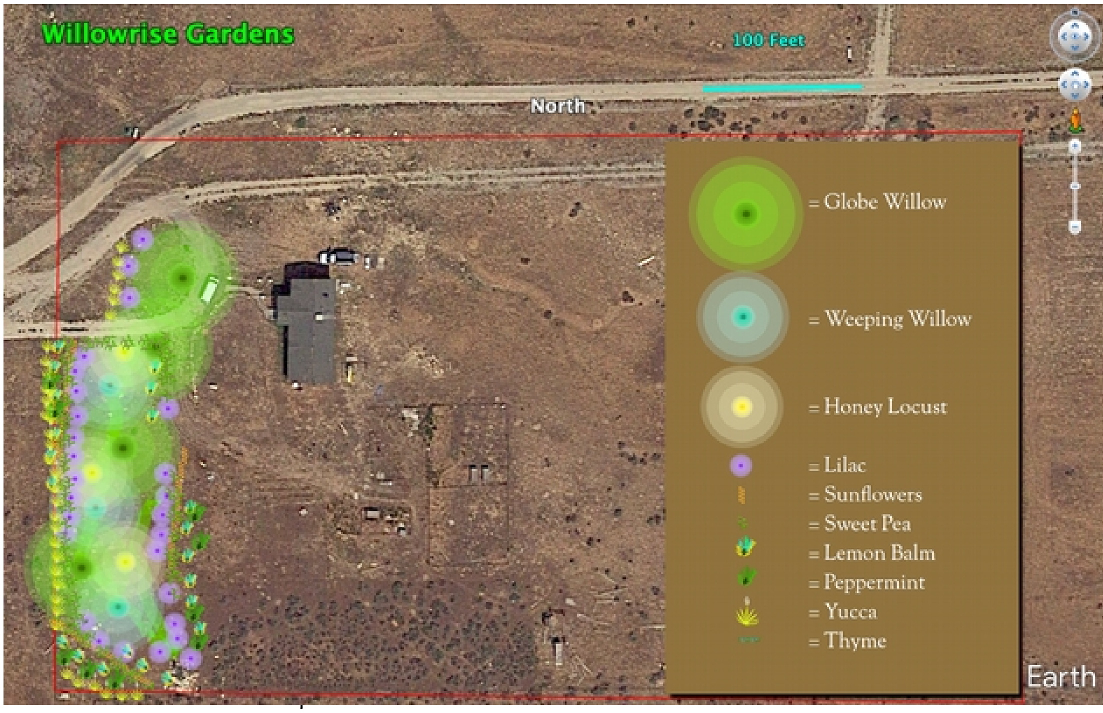
Zone 3: The Communities

In general, zone three will have hardy larger trees, and the yield focus will be nuts, saps, and perennial vegetables. Rhubarb will line slopes and open areas throughout the zone, along with wildflowers, garlic, leeks, and other hardy, low-layer species, both to invite pollinators, detract harmful insects, and provide a pleasant atmosphere and harvestable yields of food scattered throughout.

A fire break will be kept free of flammable plant life, but used for firewood preparation in the winter (chopping, etc).



Zone 3 encompasses several plant communities, including:



The Southwest Wind Break Community:

Where willows, honey locusts, lilacs, and several smaller species will keep the worst winds from drying out the land too quickly in the spring and summer.

Wildflower and Grass Community

This community will include a mix of wheat, rye, oats, flax, daffodils, jointed goat grass, barley, corn, sorgham, and other hardy grasses and wild flowers. The goal with this community is to grow harvestable grains that can eventually grow with little to no watering needs.

The Strawberry Rhubarb Pie Community:

Here there will be strawberries, rhubarbs, dill, raspberries, blackberries, and rosemary will grow on a somewhat steep hill right up next to the house on the east side facing north. These will be watered primarily by grey water coming from the laundry washer (Dr. Bronner essential oil soup for detergent).

Pond Community

This community will include cattails, horsetail, water cress (nasturtium), wild rice, onions, clumping bamboo (*Phyllostachys decora*), and chamomile, each either in, touching, or nearly touching the water's edge. Slightly uphill of the pond, where water does not touch, but does wick a little, will be planted asparagus, radicchio (on south facing slope), broccoli, rhubarb, garlic, basil, rosemary, raspberries, and dill.

Maple Nut Community

Along the central swales, down the spillway from the pond and pond community, walnuts, almonds, chestnuts, maples, box elders (as well as other maple species trees), will be planted. Careful protection of these species will have to be maintained in the early years of these trees, because they won't likely be fully fenced off from deer. Most of these will be planted below or in swales in order to get the water they need.

Zone 4:

Zone 4 will be designed to emulate the natural, local landscape where untouched, mature ecosystems reside. It will include mostly large, woody trees, including firs, pines, aspen, and other large species that grow in this region naturally. The idea of this zone will be to emulate the local landscape in both appearance and species—but with just a hint of bias towards the more useful of the local species. Before the system matures (hopefully developing into a mature forest), local wildflowers, bushes, herbs, and ground covers will be used. The placement of individual elements will be based on observations of local wild forests and mountains—observations that take into account water flow, slope, solar aspect, soil type, water access, etc.

Zone 5:

Zone 5 is the zone where I have opted to do nothing but protect, observe, and very lightly harvest from it. It will basically be left alone to see what nature does with it without the input of a gardener or designer. If seed, roots, or other plants from other zones move in, they will be left alone. If a badger moves in, I'll not bother it. This will be the zone used for observing and learning what nature does so I can mimic it in other zones.

Zone 6:

This is the kid-ravage zone. For the most part, this zone will not be designed for. Flat, hard, dirt, most likely. Rocks would get scattered, thrown (through the greenhouse windows), and kicked around, as would any other abundant substance (wood chips, etc). Concrete *could* be laid here, but kids hurt themselves on concrete (sigh). When our kids move out, and ravaging won't be every single day, we'll probably plant grass there. For now, we'll stick with dirt. Plus, our kids love dirt—digging in dirt, rolling in dirt, putting dirt in their hair… you know, normal kid stuff.

Use of Permaculture Principles

Permaculture Principles

How Willowrise Gardens is Implementing the 12 Permaculture Principles:

1. Observe and interact

During my first year on the property, I did very little planting, and a LOT of observing. With each passing year, I've tried a few more things, and observed the results. The most dramatic and successful results act as feedback to create more of the same effect elsewhere on the site.

I've noticed that I have to be working in the yard for about a half-hour before the animals and wildlife will really start ignoring me, so I try to schedule my work such that I can be out there at least 45 minutes as often as I can. While 15 minute bursts may serve to "get things done," they don't allow for real-time observation of how the animals, weather, and landscape interact with each other, and me. I can tell I'm doing it right when wildlife comes close to me, noticing but ignoring me, and I observe but don't react. Yes, I could chase the deer away from my garden patch, but by allowing and observing, I discover ways to adjust the system to prevent them getting into it at all. After all, if I can only keep them out while I'm in the yard, the yard will be devoured whenever I'm not home.

As for plants, I try to record in a journal any observation I can, since it may be useful information later.

Example: *March 6, 2019, first filaree (Erodium cicutarium) growing under newly melted snow observed.*

Over several years, such observations will be able to be mapped, calendared, and act as incredibly effective indicators of seasonal tendencies, etc.

2. Catch and store energy

Water:

Water is to be caught passively through on-contour swales, catchment ponds, and rooftops.

It is to be stored first in the soil, then through ponds, then through about 2,500 gallons- worth of water storage containers. These storage containers are filled primarily by roof water runoff.

Heat:

House-heating: The house will be heated via wood-burning stove, and much of that wood (hopefully eventually all) will be supplied by tree branches pruned on the property.

Also, neighbors bring pruned branches from their trees to our property instead of the local dump. These are used for getting tree clippings for rooting, fencing, animal shelter wikiups, chipped for organic material, and/or cooked for heating. Prior to use, these branches are placed in dry, overgrazed areas to be stored until needed for use. Thus their presence can increase the natural fertility of those overgrazed/degraded area.

Water-heating: Some water, stored in water barrels (such as 55 gallon drums) will be painted black, and cycled through black hoses that sit in daytime sunlight to be heated by the summer sun to facilitate afternoon or evening baths in order to reduce the need for propane water-heating.

Some water will also be heated via can/heat-safe bag attachments on or against wood-burning stove in winter to supplement water-heating.

Sunlight: Sunlight will be first harvested via photosynthesis in plants, but secondarily harvested via solar panels feeding a solar battery to reduce electric costs of the home.

3. Obtain a yield

Fruit: With hundreds of fruit trees of as many varieties and species as possible, as well as vines, bushes, and herbs, it is hoped that fruit (including berries, grapes, tree-fruits, etc) will be abundant.

Vegetable: with thousands of perennial vegetables that are well-chosen for the site, it is anticipated that we will obtain a high yield of vegetables.

Wood: Wood will be harvested on the property from large, woody trees, for fence and building material, for chop-and-drop mulching, for structures, for wildlife habitat, and for the wood-burning stove.

Animal: Through breeding, ducks, chickens, and geese will be raised on site, used (occasionally) for meat, and regularly kept for egg production. As the system approaches climax and/or stabilizes, it is anticipated that this will cost nothing in money, but may actually provide supplementary income as we sell our excess in birds, meat, and eggs. In addition, bugs, slugs, snails, and other less-desired creatures produced on the property will become chicken feed.

4. Apply self-regulation and respond to feedback

In order to maintain some semblance of stability, careful attention will be paid to ensure that excess of any yield or population does not exceed it's use in the system. For example, if too many chickens hatch in a year, they will be either sold, harvested for meat, or traded for other needed goods, so they don't grow to maturity and devour other parts of the system. Whenever possible, overabundance will be either be sold, freely given, or fed back into the system in some way. For example, overabundance of fruit that cannot be sold will be stored via bottling/canning, dehydrating, mulch, compost, worm-farming, chicken scraps, or planted to start new trees. More successful efforts to recycle will be used more often. Notes and calendaring will be kept to see that we are constantly learning, and adjusting according to the feedback received.

5. Use renewable resources

A major focus is to be placed on using materials that can be fed back into the system. Everything from the type of pots used for planting to the kind of bags used when grocery shopping will be taken into consideration. Anything that inherently produces waste (such as heavy synthetics that can't be reused) will be examined carefully to see if there are alternatives to the product. Milk cartons, for example, may be preferred over milk jugs, as they can be used in worm-bins, fireplace kindling, craft projects, or compost.

The goal here will be to have everything that comes in feed the system, and very little go out.

6. Produce no waste

(see #5)

7. Design from pattern to details.

Though only partially addressing the concept, many of the details designed into the Willowrise Gardens site are based on larger patterns observed in the wider landscape. For example, while there is little water runoff along ground surfaces where wild grasses and brush grow (most of it comfortably soaks into the surface—which we want), there is a great deal of water that flows down the road that runs parallel to the property as snow runoff. Potentially thousands of gallons of water flow down the hard-packed muddy road during this wettest snow-melting season. So in our design, several yards (enough that cars will scarcely notice the change) of the road will be "swaled" to subtly divert the water onto the site, down into a ditch that drains into a larger swale, causing thousands of more water to soak into the soil than would otherwise occur.

Another pattern observed is that about 50% of all wind comes from the west, most commonly in the spring. As such, the design includes a thick windbreak that will not act as a wall to stop the wind, but rather a ramp to encourage the wind to divert to above the site. And in order to even better prevent heavy eddies in the wind coming down over the windbreak, taller, more porous trees, interspersed between the thick windbreak trees, will be nitrogen-fixing trees to act like a porous screen to soften even the wind that makes it over the windbreak.

8. Integrate rather than segregate

Willowrise Gardens is designed to integrate as many types of plants of as many plant families as possible in order to maximize the potential benefits each species provides for the others, while being careful not to jeopardize some species by planting them with or near other species that may be detrimental to it. Companion planting and plant guilds will be a major part of the system. Also there will be areas for heavy experimentation to see (aside from what can be found by studying the work and experiences of others locally and on the Internet) to discover which plants do especially well together. Basically in any given zone or area of the site, there will be experimental "pockets" where ideas and experiments can be tested. Based on the observations made, more successful combinations will be used more widely. Such experimental areas will be called labs, so for each zone, there will be designated labs (zone 1 lab, zone 2 lab, etc).

9. Use small and slow solutions

Since the primary objective of Willowrise Gardens is the establishment of a fruitful food forest, care will be taken to set up passive water harvesting areas for all tree areas, providing for an ongoing water solution. Some of these trees will be grown for the express purpose of paving the way for other plants, animals, or building projects to occur. Such implementations will take time to erect, time to plant into, and time to grow. That's why it's anticipated the fully climactic system desired will take about 30 years. The intent is not to make it all happen now, but rather to plug through slowly in order to allow learning, observation, needed work, and receiving of feedback to occur.

10. Use and value diversity

It is my observation that in nearly any square foot healthy patch of green ground you will find at least seven species of plants and/or fungi. Willowrise Gardens uses that guideline as a goal: that in any square foot, seven or more species can be found—with the obvious exception of the trunk of a large tree, a boulder, and so forth. Weeding will not normally be done. If there is an unwanted species in an area, that species will be replaced by either something that fulfills the same function, or is a more desirable species of the same family. For example, if bindweed becomes persistent in an area, we will assess the reason (is it filling in newly broken soil? Covering scorched ground? Etc), and then replace it with either Morning Glory or some kind of hardy ground cover, such as clover, alfalfa, or thyme.

Wherever possible, in every zone, there will be at least seven species from different plant families. This will ensure great variance in the potential functions of each species. Effort will also be made to allow plant species that fill each permaculture layer (canopy layer, vine layer, etc).

Also, rather than destroying hardy useful "invasives," place will be made for their growth, and education will be obtained regarding their usefulness, in order to maximize the yields of plants that will grow without effort on my part. I'm a big fan of valuing the marginal, finding the value in what is already readily available, and finding ways to obtain yield from them.

11. Use the edges

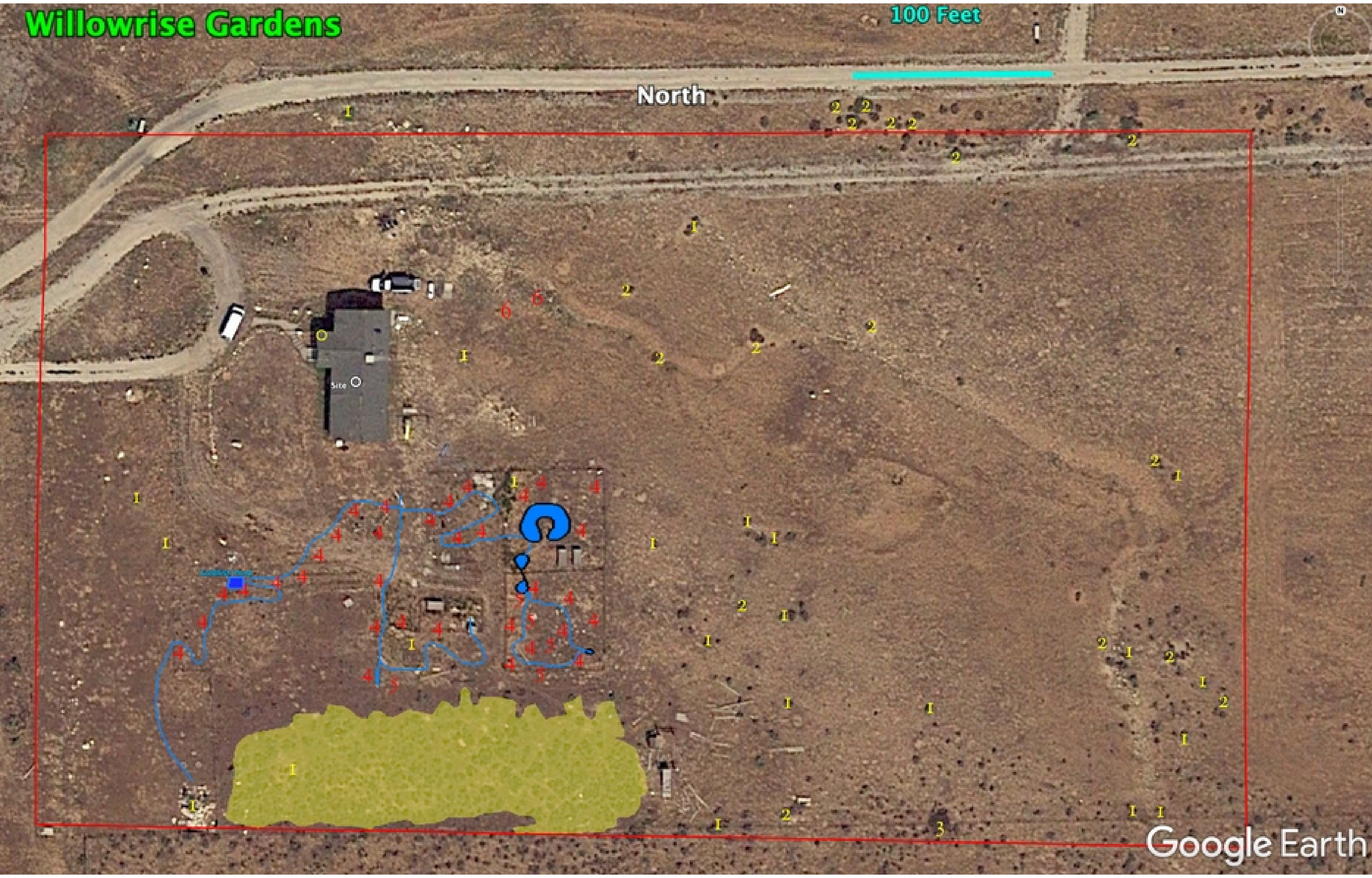
In order to maximize the opportunity for edge effect, Willowrise gardens will have great variance in ground shape, elevation, and structure. Small, long, or oddly shaped ponds will dot the landscape. Places will be made for rock gardens, hills, dips, ditches, and various structures will be placed to increase the number of microclimates and potential wildlife habitats.

12. Creatively use and respond to change

As mentioned earlier, each zone will have lab areas for experimentation and experiential education. As new events take place (a surprise flood, a particularly dry season, a random tornado or other natural disaster, notes will be taken about what happened, it's effect, before and after photos (where possible), and the year-after results. Most of this will be done electronically in order to ensure the ability to backup the observations and learning, but will be annually printed as journals that can be studied, examined, investigated, and learned from for decades to come.

Vegetation:

In this graphic, yellow numbers are representative of plants that were on the property already when we arrived four years ago. Red represents plants we've already planted (which have survived—there have been dozens that have died already), and green represents plant we intend to put in.



Existing Vegetation:

The vegetation existing on the property in a mature state (it was here before we arrived three years ago):

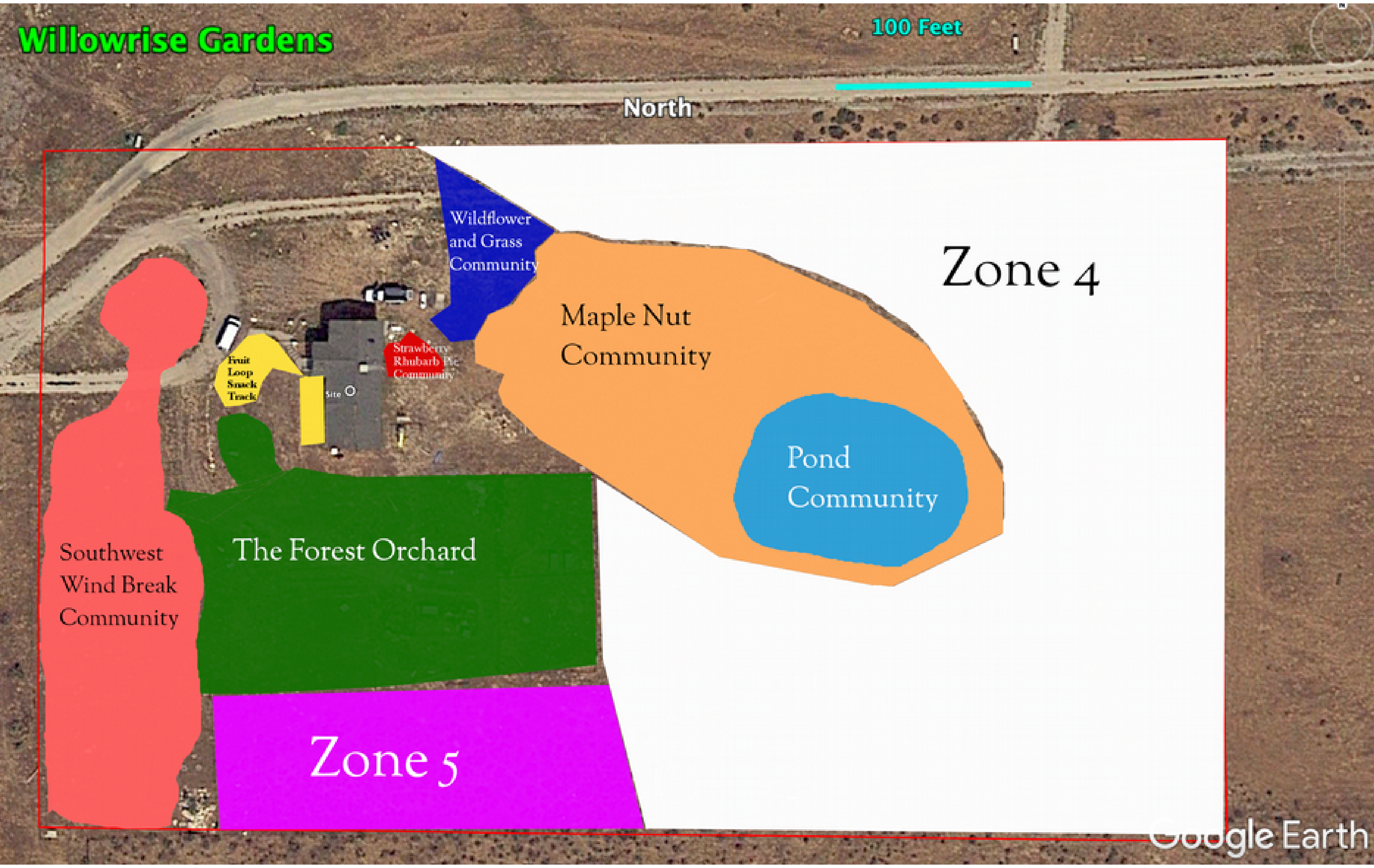
0. Virginia Creeper
1. Rabbit brush
2. Big Sagebrush
3. Skunk bush

Introduced Vegetation (plants I've planted already):

4. Fruit Trees (apple, plum, peach, pear, apricot, nectarine, and cherry)
5. Globe willow trees
6. Almond Trees

Planned Vegetation:

Since mapping individual planned vegetation would be impractical, since numbers would heavily overlap and many would be illegibly small, I've mapped by communities (specific plant species are listed in the zone explanations:



Prioritize Phase Planning

To implement your design it will take time. Evaluate what will come first and why and how to continue the process to completion. Compile a list of actions and the order they will be completed in over the next 1-5 years.

While the entire design will be a continual work in progress, the initial design designated here will hopefully follow the following schedule (give or take):

1. Plant fruit trees as they become available and protect them in whatever way is possible. (Immediately, without delay, and continuing for the next 5 years)
2. Seek out fencing resources—Craigslist, KSL classifieds, spring hardware sales, neighbors, friends, family, etc. And install fencing as soon and as quick as possible. (Research options immediately, act on them as resources become available. Install as much as possible in the next year.)
3. Aggressively swale the property to improve water retention. This should be worked on immediately, but should be complete across the property within two years.
4. Purchase or otherwise find access to several trees and plants that can be propagated for duplication, such as willows, lilacs, elms, box-elders, maples. Fast growing species that will provide some shelter, shade, and protection to other trees and zones.
5. Get a truck for hauling, collecting, and moving site materials (fences, branches, etc). (At *least* within two years.)
6. Obtain water-storage containers and tubs for water catchment, and install rain-gutters over the entire roof. (Within two years.)
7. Contact the county and get a small area of the site registered as a burial plot. (Within 3 years.)
8. Make sure all 5 zones are installed and fully ready for planting within three years. Hopefully by then, most will be planted, but three years is the deadline for *all* zones together.
9. Get *all* large-tree species (especially the slow growing ones) planted in their designated zones and locations within 4 years. More can be planted later, but the essential ones—the ones that are needed for the system to be fully active in the next 30 years., *must* be planted before 4 years has past.
10. Get solar panels, any small-scale windmills, or other energy creators installed within 5 years.
11. Have a fully functioning permaculture business—selling, teaching, consulting, etc, within 5 years. Having run business since 2007, I know it takes time to fully establish a business well after it is started, so it is anticipated that the business side of things will start right away, and the next five years will be to iron out, experiment, create, implement, and bring to fruition a mature, successful permaculture business.

Soil Plan

While every zone of activity will have a built-in plan to feed and replenish it's own soil (such as chop-and-drop, regular mulching, periodic animal activity, etc), There will also be areas where soil is being actively built to be used in new and underdeveloped areas in the design. This soil farm will be a place where hay, sawdust, sticks, mulch, and compost will be laid down and then topped with wood and branches for branch storage. Walking over a woodpile (which itself would be a challenge anyway) won't adversely effect the soil being built below, because the wood being stored masked it like a thick wooden web over the developing soil.

Once that spot has been breaking down for a couple years (while branches may be used and replenished above), and good soil is needed elsewhere, branches will be removed and the ground will be dug up and carried in wheelbarrows or truckloads (depending on the size of the area that needs it) to the site ready for planting or regenerating.

Enough branches are brought and sitting on the property to make this easily cycle-able over many years. Eventually these soil-building "piles" will become obsolete for use outdoors, since the zones approaching climax will be able to meet their own soil needs, and will be only needed in small batches for indoor plants.

If all goes well, each place where new soil is laid will only need new soil once or twice, so that mycelial/fungal networks can form, and mulching may be all that is needed to help maintain those areas.

Phase Planning List:

Deciding how to best roll out this design is a bit of a challenge (as it would be for any design), because of the strong limitations of costs and the unpredictability of available resources. Obviously, the sooner I get a tree in the ground, the more likely I am to have a robust, well-established tree in 10 years. But if I don't provide fencing and protection to that tree, it won't live long enough to make it ten years.

But without either great connections or money for fencing, there is a limit on what can be done to protect large numbers of trees. Also, food-stamps (a notoriously unpredictable resource) is willing to pay for fruit trees, so the opportunity to obtain them right away probably shouldn't be neglected.

Also, we can plant annual/biennial crops right away, but if wind-blast and wind-drying is decimating the garden, we still don't get a yield, let alone seed for next year.

So here's what I'm thinking might be the best approach for now—partially in order of *when* to start, and partially in order of priority of *what* needs to be done:

1. Start planting fruit trees as soon as possible, providing each tree individual small-scale protection using whatever means is possible—temporary fencing, wood stack (branches all around the base of the tree to divert, distract, and prevent deer from reaching the trunk), dried Russian thistle piles climbing the tree, etc. (6-months deadline)
2. Get water-retention swales in place above trees to provide immediate access to water. (6-months deadline)
3. Build simple fencing where possible—even if only temporary, with the idea of building more permanent fencing in the not-so-distant future. Prioritize fencing zones 1 and 2. (1.5-year deadline)
4. Get willows growing with other deer-resistant plants started growing in the southwest windbreak community. Root lilac cuttings. Plant sunflowers and sweet pea (9-months deadline)
5. Plant biennial garden in the protected garden area to get save-able seed for the years to come. (3-months deadline)
6. Plant any deer and chicken-resistant perennial vegetables as soon as possible. (1-year deadline)
7. Once zone 1 fencing is installed, heavily plant zone 1. (two-year deadline)
8. Intensively swale the whole site. (5 year deadline)
9. Put out hardy pioneer species trees in zones 3 and 4. (Ongoing, but starting with 2-year deadline)

10. Get as much hard-core fencing installed as possible, and then plant the heck out of every fenced-in area. (Ongoing, but starting with 2-year deadline)
11. Fence in large pond area, line and fill the pond, and plant maples, box-elders, nut trees, and other hardy, water needing plants around it. (3-year deadline)
12. Plant wood-harvesting trees along north and east perimeter of site (3-year deadline)
13. Anything in the design that hasn't gotten done (7-year deadline).

In all of this scheduled effort and deadlining, I need to maintain sufficient flexibility to be able to roll with opportunities that come along. For example, if one of the pruning workers that supplies my wood pile drop off a load of fresh globe willow branches, I have about three days before those branches start seriously losing viability for rooting. If I can get them in the same day, the results will be incredible. So I need to be able to drop what I'm doing to work on that immediately.

Likewise if someone offers me fencing materials—that immediately gets high priority, since fencing opens up so many more possibilities once it's in place. I have people offer potted suckers from their trees, and those have a matter of days before they'll start dying if I don't get them in the ground.

Basically, I'll try to roll out the work in the order that will work best, but I've also got to roll with the punches that come. But that's okay, that's one of the things that makes this whole effort exciting!

Social Permaculture Reflections

How does your design address and improve social and cultural conditions in your area?

Water is a primary concern for people in this region—between conflicts over who gets the irrigation from which local reservoirs, the costs of water shares, the depletion of the local water table, and the regularity of drought, water—or the lack thereof, is a concern among all agricultural people of the community.

My design, if well executed, should demonstrate that it is possible to raise food without the need of endless inputs of underground water or spotty irrigation. By choosing species that can establish locally, a few years of providing inputs to get things started, and by reshaping the landscape to harvest every drop of water for the benefit of the site, it shouldn't much matter if it's a "drought year," or if the neighbor county gets "our share" of the reservoir. All of the water needed for the site can be harvested passively *on site.* The hope is that by so demonstrating, others will see the potential, and likewise implement such strategies, bringing about the greening of our valley such that within a generation, we can not only avoid depleting the water-table, but actually get it to rise considerably.

The primary means of passive water collection will be by on-contour swales, installed at regular intervals throughout the site (about every five feet of elevation), along with catchment ditches along the borders of the property that feed into those swales.

The spillover from the swales will feed into further swales, which feed into catchment ponds.

Also, water catchment systems around the roof of the house on the property will be installed that will hold hundreds of gallons of water, but will then feed into swales that flow down into catchment ponds.

Appendix:

In many of the zones mentioned, not all of the layers are accounted for, and while I'd like to let the design respond naturally to the efforts made, there will be gaps—some plants that don't take, some layers that don't get filled, and some plants that get eaten by wildlife no matter how hard we try to protect it. In response, we have a list of plants to encourage in the system based on the situation of the zones, or to obtain to add to the system. These are constantly growing lists, so there will be more plants added to this in the future.

Plants in the system now that we'd like to multiply and get more of:
Dandelion, *taraxacum officinale* (dynamic accumulator, useful edible and medicinal)
Common Mallow, *Malva neglecta*, (great edible)
Amaranth, *Amaranthus retroflexus*, (great edible, good pioneer species)
Lambsquarters, *Chenopodium album*
Yarrow, *Achillea millefolium*

Other plants I would love to add to the system, *if* they become available:
Sorrel, *Rumex scutatus*
Hardy Kiwi, *Actinidia arguta*
Stinging Nettle, *Urtica dioica*
Comfrey, *Symphytum officinale*
Purslane, *Portulaca oleracea*
Meadowsweet, *Filipendula ulmaria*
Garden Cress, *Lepidium sativum*